sampling and statistical aspects of numerous projects, both large and small, for many corporate and government clients. One of my main professional interests has been in developing ways of turning operating data systems into statistical information systems – an area on which I have published extensively. This was particularly important when I was at the IRS and SSA, which have some of the biggest operating data systems in the Federal Government. My large systems experiences were especially relevant to the analyses in this report which had to be developed from BellSouth's truly massive datasets.

Susan Hinkins Qualifications

1. I have been a professional statistician for 20 years. In 1971 I obtained a B.S. in mathematics from the University of Wisconsin-Madison, an M.S. in mathematics in 1973 and a Ph.D. in statistics in 1979 from Montana State University-Bozeman.

   Since July 1998 I have worked at Ernst & Young LLP where I am now Chief Mathematical Statistician for Statistical Sampling. Before coming to Ernst & Young, I was a senior mathematical statistician at the U.S. Internal Revenue Service. My work at the IRS related primarily to business data, notably that on corporations. I was responsible for developing and maintaining a large and complex sample from a population of approximately 4 million corporate returns.

   I have also worked on a large project funded by the Environmental Protection Agency (EPA) to do an exploratory data analysis of a complex sample of all lakes in the U.S., measuring water chemistry and physical characteristics. While working for the EPA, I also coordinated a study to compare various methods for measuring the level of radon and radon-daughters in homes.

2. I am a member of the American Statistical Association (ASA), the Washington Statistical Society, and I am the Secretary/Treasurer of the Montana Chapter of the ASA. I am also a member of the Institute of Mathematical Statistics and the scientific research society, Sigma Xi.

3. My interests and experience have lead me to specialize in the analysis of complex samples, data imputation, and related estimation issues. I have authored and co-authored numerous papers dealing with these issues. Of particular importance in the current context is the work I have done on replicate variance estimation and its application to complex sample data. The replicate approach we recommend in the report to BellSouth grows out of my theoretical work and prior practical applications.

Ed Mulrow Qualifications

1. I have been a professional statistician for more than 10 years. I obtained a BA in mathematics in 1980 from Illinois Wesleyan University, an MS in mathematics from the

University of Utah in 1982 and a Ph.D. in statistics from Colorado State University in 1986.

Since April, 1998, I have worked at Ernst & Young LLP where I am now a manager in the Policy Economics and Quantitative Analysis Group. At Ernst & Young, I have capitalized on my extensive prior defense simulation experience and taken the lead on large scale simulation modeling in commercial business settings. This has included distribution free estimation using normal and near normal data sets.

Before coming to Ernst & Young, I was a senior scientist at Science Applications International Corporation (SAIC) where I was involved in the analyses of current and future defense systems. In addition, I was the project leader for the development of a database system used to track funding for Department of Defense Information Technology projects. I also worked at the National Opinion Research Center (NORC) as a senior sampling statistician, where I developed a prototype sampling system. The system consisted of a data warehouse of all the information needed to sample from several national sampling frames, and software tools that access and process the information. I headed a committee that oversaw the acquisition and use of a geographic information system (GIS), and was the lead statistician for NORC on record linkage projects. Before moving to the defense/business environments, I was an Assistant Professor of Mathematics at Southern Illinois University - Carbondale.

2. I am a member of the American Statistical Association, the Washington Statistical Society, the ASA Statistical Computing and Graphics Section, and the Military Operations Research Society, in addition to managing the membership database for the Caucus for Women in Statistics.

3. I have co-authored statistical articles and refereed papers for several domestic and international journals. My interests and experience lead to special expertise in statistical computing and graphics, time series analysis, record linkage, geographical information systems and the design and development of large databases.

Appendix B
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Appendix B
Statistical Calculations for Two Performance Measures: Completion Interval - Provisioning and Maintenance Average Duration

Purpose and Structure

This appendix describes three methods for testing the hypothesis that the CLEC orders are being treated in a comparable manner to the BST orders. Examples are drawn from the Completion Interval - Provisioning measure, but the method also applies to the performance measure Maintenance Average Duration.

First, the model assumptions and properties of the FCC and the LCUG methods are described. Then we describe how the underlying assumptions for these tests are not valid in this situation, and how such model misspecification affects the tests. We describe what we believe is a more reasonable model and our proposed replicate methodology. We provide the formulas for the six test statistics given in the main report, namely the LCUG, the FCC, and the proposed BellSouth method, unadjusted and adjusted. Finally, we summarize the steps for our proposed replicate method, including the data analysis steps and test procedures, and we reiterate the reasons why this method should be adopted.

Basic Theory

Statistical texts generally have at least one section describing the comparisons of two populations, textbooks such as Snedecor and Cochran (1967), Hogg and Craig (1970), and Kempthorne (1973), for example. And often, as in this case, the interest is in comparing the location of the two populations, measured by the mean or the average value. The assumption is often made that the observations are from two normal distributions (the treatment and the control) with the same variance or dispersion but different means. For each population, the observations are assumed to be independent and identically distributed (IID).

These are very strong assumptions and may not hold in many applications. In the performance measures considered up to this time, the underlying distributions are clearly not normal, nor even symmetric distributions. However, the great advantage of considering a comparison of means is that the distribution of the mean value can be approximated by a normal distribution, using the Central Limit Theorem, if the sample sizes are large enough and the underlying distribution is not too skewed. Therefore, a reasonable alternative assumption is that the sample means, say $\bar{x}_1$ and $\bar{x}_2$, are normally distributed and are *independent*. The assumption that the two populations have the same variance is necessary to use the standard test; if the variances are unequal, adjustments must be made to either adjust or approximate a t-distribution for the usual test statistic.

A very important underlying assumption is that the data are the result of a designed experiment, where the "treatments" are assigned randomly to the units of analysis. Any confounding factors or possible blocking effects are taken into account in the design of the experiment and all other assignments are randomized in order to remove bias due to any remaining systematic differences in the units.

For example, in agricultural experiments, location is often considered a blocking effect. Plots that are close together tend to give similar yields due to otherwise uncontrolled effects, such as drainage and fertility gradients. Treatments are assigned at random to plots within each block.

The block effect may be on the mean (fixed effect) or on the variance (random effect), describing correlations between units that are physically close to each other. In this case, we do not have a controlled experiment and this should add an extra note of caution, as emphasized elsewhere.

Consider the simplest general model for the two population comparison. Let x_{1i} denote the performance measurement on BST order i, i=1,...,n_1. Let x_{2j} denote a performance measurement on a CLEC order, j=1,...,n_2. Then the most basic model is

$$x_{1i} = \mu + \varepsilon_i \qquad \text{where } \varepsilon_i \sim \text{IID}(0, \sigma_1^2)$$
$$x_{2j} = \mu + \tau + \delta_j \text{ where } \delta_j \sim \text{IID}(0, \sigma_2^2)$$

and the two means $\bar{x}_1$ and $\bar{x}_2$ are independent. If the underlying distributions are not too skewed and the sample size is reasonably large, then one can reasonably approximate the distribution of the difference in the means as normally distributed

$$\bar{x}_1 - \bar{x}_2 \sim N(\tau, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}) \qquad (1)$$

and we are interested in testing whether $\tau = 0$.

FCC Measure. In addition, it can be assumed that the variances are the same in each case, $\sigma_1^2 = \sigma_2^2 = \sigma^2$. That is, it is assumed that the two distributions are the same, except for a possible difference in the means, due to a "treatment" effect.

These are the assumptions used in the FCC measure. A pooled estimate of the variance is used, s_p^2, and the resulting t-test is

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{1/n_1 + 1/n_2}}$$

with $n_1 + n_2 - 2$ degrees of freedom. It often turns out to be the case that the sample sizes will be large enough so that the normal, or Z, distribution can be used rather than the t-distribution.

In at least some cases in the Louisiana data that we have studied, it does not appear that the assumption of equal variance is valid. There are two other measures that are being

considered - the LCUG and the measure that we prefer. Neither of these measures assumes equal variance.

LCUG measure. Rather than assume that the variances are equal, the LCUG estimate simply uses the BST population variance as the standard for comparison. The t-test then has n_1-1 degrees of freedom and the test statistic is of the form

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_1\sqrt{1/n_1 + 1/n_2}} .$$

Again, if the assumptions for the test hold, the BST sample size is usually sufficiently large that the normal distribution is appropriate for calculating p-values.

If the two distributions are identical except for location, then the FCC is a test of the equality of the two distributions. If the variances are not equal, then the interpretation of the test is endangered. If one is concerned about the assumption that the variances are equal, then using the BST variance is a reasonable alternative.

Even if the variances in fact are equal, it costs very little to use the BST variance rather than the pooled variance. And if the number of BST cases is much greater than the number of CLEC cases, it could even be preferred because of concerns about pooling the data with relatively few CLEC cases.
If the variances are unequal, then the correct test would be based on equation (1) and the test would be of the form

$$t' = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s_1^2/n_1 + s_2^2/n_2}} .$$

If in fact the BST variance is less than the CLEC variance, then the LCUG test is more stringent, harder to "pass" than the correct test. If the BST variance is greater than the CLEC variance, then the LCUG test is not as stringent as the test using both variances, as in equation (1). Our test, which will be described in this appendix, also does not assume equal variances, and if the assumption of independence holds, our test uses a "correct" variance estimate in that it estimates the variance in (1).

First Steps in Data Analysis

The first performance measure that we analyzed was the Completion Interval-Provisioning for the months August and September. This is measured in days and estimates are made separately for dispatched and non-dispatched orders, and also separately by the type of order: "residence," "business," or "special designed" orders, and by two classes determined by the number of circuits.

The "Non-Designed" Maintenance Average Duration performance measure is measured in hours, and estimates are made separately for dispatched and non-dispatched orders, and separately for "residence" and "business" orders. The examples used in this discussion come from the Completion Interval - Provisioning measure, but the techniques apply to both measures.

The first step in the data analysis was to verify the data set. This was done by calculating the estimates and comparing them to the published estimates on the BST internet website (https://clec.bellsouth.com).

Trimming. The underlying distribution of the orders is clearly not normal, but rather skewed with a very long upper-tail. (See Appendices C and D.) Extreme data values may be correct, but since they are rare measurements, they may be considered to be statistical outliers. Or they may be values that should not be in the analysis data set because of errors in the measurement or in selecting the data.

The arithmetic average is extremely sensitive to outliers; a single large value, possibly an erroneous value, can significantly distort the mean value. And by inflating the error variance, this also affects conclusions about whether $\tau = 0$. A useful technique, coming from the field of robust statistical analysis – for example Huber (1981), or Wiens, Wu, Zhou, (1998) -- is to trim a very small proportion from the tails of the distribution before calculating the means. The resulting mean is referred to as a trimmed mean. Trimming is beneficial in that it speeds the convergence of the distribution of the means to a normal distribution. Only extreme values are trimmed, and in many cases the data being trimmed are, in fact, data that might not be used in the analysis on other grounds.

In the first analysis of the verified Completion Interval-Provisioning measure, after removing data that were clearly in error or were not applicable, we looked at the cases that represented the largest 0.01% of the BST distribution. In the August data, this corresponded to orders with completion intervals greater than 99 days. All of these were BellSouth orders.

In examining the largest 11 individual examples that would be removed from analysis, we found that only 1 of the 11 cases was a valid case where the completion interval was unusually large. The other 10 cases were examples of cases that should not have been included in the analysis.

Of the 11 largest values, eight were orders which are "official BellSouth orders"; these are internal jobs which are not real orders but which needed an order number for tracking purposes. These orders can be identified using the data field "general class service" and such orders were subsequently removed from the analysis data file.

Two of the cases were orders where the customer requested a later due date than offered by BellSouth. The customer called in February to place an order for August, for example. There is no easy way to identify such cases in general, in order to remove them from analysis.[1] The system is not yet stable; hence, there may be other types of data points that should not be included or that are not measured correctly. A very slight trimming is needed in order to put the central limit theorem argument on firm ground.

[1] As a result of our analysis, we eliminated further records from data analysis, both above and below the 99 days, using the information regarding general class of service (official BellSouth orders). The subsequent trimming only removed 15 BST cases from the August BST file and 13 BST cases in September.

We now have a data file of CLEC orders to compare with a data file of BST orders. However, both the tests described earlier treat the problem as if the observations come from a designed study where treatments are assigned at random to units in the population. This is not the case here; rather what we have in the BST and CLEC comparison is an example of an observational study. This is an extremely important distinction that cannot be ignored.

Observational Studies

As is well known, randomization in a designed study is a very powerful tool in removing or reducing bias due to systematic differences in units. A few of the references dealing with the importance of randomization and the difficulties inherent in observational studies would include Fisher (1925); Cochran and Rubin (1973), Holland (1986), Rosenbaum (1987).

In an observational study such as this, there may be variables other than the "treatment" that affect the dependent variable (performance measure) and these variables may be differently distributed across the treatment groups. With the presence of confounding variables, a basic approach would be to list the major confounding variables and find some method of removing or reducing the biases that they may cause.

It is necessary to consider the business structure. Like the agricultural example, "location" in the business should be considered for blocking effects. It seems reasonable that there may be a positive correlation between performance measures within a business unit or a geographic location. The use of the "wire center" was considered as the best location measure. Scatterplots are presented in the main report that illustrate that there is a correlation between BST and CLEC measures.

Blocking or clustering effects in the data mean that the observations are neither independent nor identically distributed, two assumptions made in the LCUG and FCC testing approaches. A positive correlation between the performance for orders within a location would mean that the variance estimates used in both the FCC and the LCUG tests are biased and, in particular, they underestimate the variability in the differences.

Additionally, one might expect that the time of the order may be correlated with the performance; clearly extremes in weather would affect the performance. And one might certainly expect a time and location interaction effect. In the BellSouth comparisons, the data are examined on a monthly basis, which is determined by when the order is completed. Weather conditions occur on a shorter time frame. In the case of these two performance measures, each month is divided into just two components, the first half of the month and the last half. These divisions are made so that the time is divided up as evenly as possible by the days of the week as well.

In addition, for a given performance measure, there may be different types of orders and different types of customers. For example, in the provisioning example, the measurements are compared by dispatch vs non-dispatch, residence vs business vs "special designed", and by the number of circuits. In addition one might want to consider the type of order in terms

of "new" vs "change" vs "transfer". It appears, for instance, that a "new" order takes noticeably longer to finish than a "change" or "transfer."

Finally, if one were designing a study to compare the CLEC to the BST "treatment," one would make sure that the same number of CLEC and BST cases were assigned by the location, by time, and by the type of order. By using random assignment to assign a population unit as either a CLEC or a BST, one would be protected against the possibility of other unsuspected sources of bias. That is, if there is another variable that affects the performance measure, by using random assignment one is likely to assign approximately the same proportion of BST and CLEC orders across the distribution of this variable.

Without random assignment, there is the possibility that the distribution of these confounding variables is very different for the BST orders than for the CLEC. For example, if "new" service tends to take longer than the other service types and one month 50% of the CLEC orders are "new" compared to 25% of the BST orders, then the simple comparison will be biased. The bias may work in either direction, depending on the distribution of the observed data. In the example above, the simple estimate would overestimate the difference between the BST and the CLEC performance, making the CLEC customer performance look worse than that for BST customers since CLEC provisioning would appear to take longer. If the distribution had been out of balance in the other direction, with a higher percentage of new BST orders than new CLEC orders, then the simple estimate would have made the CLEC performance look better than it was.

In summary, the assumptions made for both the FCC and the LCUG tests are not valid. The observations are not likely to be independent and identically distributed. Assumption failures may affect both the numerator (the point estimate of the difference) and the denominator (the estimate of its variability). Clustering effects in the data, resulting in a positive correlation between observations in the same wire center, would mean that the variance estimates used in both the FCC and the LCUG measures are biased. And, in particular, they will underestimate the variability in the differences. In addition, effects due to time or order type may bias the estimate of difference.

Adjusted Estimates. In an observational study, bias is a major concern. There are many references for estimation techniques using data from observational studies. There are two principal strategies for reducing bias in observational studies (Cochran and Rubin, 1973): matching and model related adjustments. When the confounding variables are classification measurements, as they are in this case (new vs. change, time 1 vs. time 2 etc), then both matching and model based strategies lead essentially to the same simple adjustment.

Suppose there are j=1,...,J classes defined by the confounding variables. (One class might be new service in a residence, dispatched service, with less than 10 circuits, finished in time period 1, in wire center "a.") Suppose there are n_{2j} CLEC cases and n_{1j} BST cases in class j with $n_{2j} \geq 0$. The following

estimate of the difference in the means will be subject only to residual biases due to confounding variables "missed" in the classification (Cochran and Rubin, 1973):

$$\hat{D} = \frac{\sum_j n_{2j}(\bar{x}_{1j} - \bar{x}_{2j})}{n_2} \qquad (3)$$

where n_2 is the total number of CLEC observations. Note that there may be classes for which there are BST units but no CLEC units. If this occurs, these BST units are not used in the comparison. This is reasonable when comparing "likes to likes," as required by the Louisiana Commission. Data unique to the BST process should not be used in such a comparison. It is very unlikely that there will ever be a case where there are CLEC observations in a class but no BST observations. So this concern is not directly addressed here; we simply have not seen any examples. In other settings, though, there may be no retail analogue for certain resale activities. Cases with no retail analogue are out of scope in this analysis.

The estimate in equation (3) can also be written as a difference between an adjusted BST mean and the CLEC mean, where BST cases have been weighted or adjusted to represent the CLEC distribution by class. That is,

$$\hat{D} = \bar{x}_{1A} - \bar{x}_2 \qquad (4)$$

where $\bar{x}_{1A}$ is the ILEC adjusted mean:

$$\bar{x}_{1A} = \frac{\sum_j \sum_{i=1}^{n_{1j}} w_j x_{1ji}}{\sum_j \sum_{i=1}^{n_{1j}} w_j}$$

where the weight for BST cases in class j is $w_j = n_{2j}/n_{1j}$, the number of CLEC cases in class j divided by the number of BST cases in class j. The sum of the weights is then simply n_2. The weights adjust the BST cases so that they are "like" the CLEC cases in number and distribution among classes. This is referred to as the adjusted mean or the adjusted estimate.

If in fact we have included all important factors, then $\hat{D}$ is an unbiased estimator for the difference in means. Notice that this estimate can be "rolled up" (or down) to provide reasonable estimates at various levels of aggregation.

An Example. The simple example from Section 3 will be used to illustrate how the adjustments are calculated. In this example, we have the following number of orders:

Service Provider	New Orders	Change Orders
Provider A	n_{11}=30	n_{12}=90
Provider B	n_{21}=60	n_{22}=30

There are only two classes, j=1,2. Recall that in this example there is no discrepancy in the means, by class. For each

provider, the mean is 2 days for class j=1, new orders, and the mean is 1 day for class 2, change orders.

Suppose we want to adjust provider A's distribution to compare to provider B. Then in the notation used in this appendix, we have

$n_{11}=30,\ n_{12}=90,\ n_1=120$

$n_{21}=60,\ n_{22}=30,\ n_2=90$

Using equation (3), the estimate of the difference would be

$$\hat{D} = \frac{60*(2-2)+30*(1-1)}{90} = 0.$$

The unadjusted means are 1.25 for provider A and 1.67 for provider B. The adjusted mean for provider A would be calculated using weights $w_j = n_{2j}/n_{1j}$, or in this case

$w_1 = 60/30 = 2$
$w_2 = 30/90 = 1/3$

and the adjusted mean for provider A would be

$$\bar{x}_{1A} = \frac{2*30*2+\frac{1}{3}*90*1}{2*30+90/3} = 1.67.$$

Because there was no discrepancy in the means, by class, the adjusted mean for provider A is equal to the mean for provider B.

Replicate Variance Estimation

The estimate $\hat{D}$ from equation (3) or (4) then is a better estimate of the difference between the mean performance for the BST orders and the mean performance for the CLEC orders. We now need a variance estimate for $\hat{D}$.

Replicate variance estimation can result in a nearly unbiased estimate of the variance for complex data structures like those which exist with the BellSouth data. A description of the basic technique can be found in Wolter (1985). The basic idea is to randomly divide the given sample into G groups, where each group has approximately the same number of wire centers. In each group g, calculate an estimate of the parameter of interest, say $\bar{d}_g$. Let $\bar{\bar{d}}$ be the average of the replicate means $\bar{d}_g$. Then the replicate variance estimate of $\bar{\bar{d}}$ is

$$v_1 = \mathrm{Var}(\bar{\bar{d}}) = \frac{1}{G}\frac{1}{(G-1)}\sum_g(\bar{d}_g - \bar{\bar{d}})^2 \quad . \quad (5)$$

In our problem, however, the estimate we are interested in is $\hat{D}$ which is not generally equal to $\bar{\bar{d}}$. We can use v_1 as an estimate of $\hat{D}$ or the alternative estimator

$$v_2 = \mathrm{Var}(\hat{D}) = \frac{1}{G}\frac{1}{(G-1)}\sum_g(\bar{d}_g - \hat{D})^2 \quad . \quad (6)$$

We have chosen to use expression (6) for the calculations of test statistics employed in the main report and in the four appendices C-F.

Detailed Problem Formulation

In what follows, an explicit attempt is made to describe the specific estimation procedure we recommend for Louisiana that compares "like-to-like" and that captures variances adequately. We are concerned about dependences which could exist in service based on where the customer is geographically or when the transaction occurs. Protecting against this possibility is one of the main motivations for our approach. Ease and simplicity are others.

In all cases, we will want to consider the following in constructing our estimates:

Wire Centers - There are approximately 228 wire centers[2] managed by BellSouth in its four LATA in Louisiana: New Orleans (67), Baton Rouge (31), Lafayette (42), and Shreveport (88)

Time - Service varies over time for many reasons, weather being perhaps the most important. To deal with this source of variation, each month's data will be divided into two approximately equal halves. Weekly increments might be better but could be too fine-grained and are inconvenient since the reporting is monthly and not even in four week periods (which arguably would be better).

Other Factors - There may be other factors considered important in their effect on performance, such as the order type in the Completion Interval-Provisioning. These have to be accounted for too.

Individual Service Order - Lastly, we have the individual order itself

Replicate Construction. We want to define the replicates only once. The replicates were defined, as described here, using the August Completion Interval-Provisioning measure and the resulting definition of the replicates by wire center was used for both performance measures in all time periods.

The wire centers were sorted within LATA by the total CLEC activity, in terms of the number of orders. Wire centers with no CLEC activity in this month were also included, with zero

[2] In the preliminary data analysis, there were 228 wire centers. But because the mapping of phone numbers to wire centers was not complete, there were phone numbers that could not be matched to one of these wire centers. These numbers were mapped into four "dummy" wire centers according to the area code of the phone number. The resulting wire centers were not assigned to a LATA but were instead put into a "missing" category . New Orleans LATA corresponds to LATA 490, Baton Rouge is LATA 492, Lafayette corresponds to 488 and Shreveport corresponds to 486.

activity. The LATA were ordered and the wire centers were ordered within LATA. Within the first LATA, the wire centers were ordered from largest to smallest. In the next LATA, the wire centers were ordered from smallest to largest, etc. We then systematically divided the 232 wire centers into 30 roughly equal groups (of about 7 wire centers). This was done by taking the ordered list and splitting it into "zones" of 30 wire centers each, randomly assigning a wire center to a group until all were assigned, then repeating the process independently for the next zone of 30 wire centers, and so on until all had been assigned.

Estimator Construction. The estimator $\hat{D}$ is calculated as in equation (3), using classes defined by wire center and time at least. The replicates are assigned, by wire center. The adjusted replicate estimates $\bar{d}_{Ag}$, g= 1,.. 30, are calculated using equation (3) but summing only over the cases in the wire centers defined to be in replicate g.

These $\bar{d}_{Ag}$ are identically distributed by construction and independent by randomization. If there is a lot of CLEC activity, they may also be approximately normally distributed. Using the replicate structure we estimate the variance for the adjusted estimate as

$$s_{rA}^2 = \frac{1}{29}\sum_{g=1}^{30}\left(\bar{d}_{Ag} - \hat{D}\right)^2$$

and the resulting statistic

$$t = \frac{\hat{D}}{s_{rA}/\sqrt{30}}$$

is compared to the Student's t-distribution with 29 degrees of freedom, as the reference distribution, for calculating p-values. The p-values are the probability of seeing a value as extreme or more extreme then the observed value of t. That is, if t is positive, the probability of a value greater than or equal to t is calculated, using the Student's t with 29 degrees of freedom as the reference distribution. If t is negative, the probability of a value less than or equal to the observed t is calculated.
Using the replicate variance estimate applied to the adjusted estimate of the difference protects against model misspecification. This test does not rely on the assumption that the data are IID and it corrects for bias due to the structure of the data. Using this method, a confidence interval can be constructed for the difference in the means. A reasonable interval is the 95% confidence interval. Using a Z-test, the multiplier is 1.96 which is often rounded up to 2.00. Using a t-distribution with 29 degrees of freedom, the coefficient is 2.045. For all practical purposes, these are equivalent. There is no loss in power in adopting the replicate measure over the FCC or the LCUG measure.

The Six Test Statistics Compared in the Main Report

The test statistic described in the previous section is the method we propose for the comparisons, and, in the main report, it is referred to as the BellSouth test for adjusted data. It adjusts the BellSouth data to make it more similar in

distribution to the observed CLEC data, and it uses a replicate variance estimator.

For comparison purposes, we can also calculate a replicate estimator for unadjusted data and we can calculate the LCUG measure and the FCC measure using adjusted BellSouth data.

The replicate variance estimate for the unadjusted data would be calculated using replicate means $\bar{d}_g = \bar{x}_{1g} - \bar{x}_{2g}$, the difference between the simple means of the BellSouth and the CLEC data in replicate g:. Replicates are only used if there are CLEC data. The associated replicate estimate of the variance for the unadjusted data is

$$s_r^2 = \frac{1}{G-1}\sum_{g=1}^{G}\left(\bar{d}_g - (\bar{x}_1 - \bar{x}_2)\right)^2$$

where there are G replicates.

For the LCUG and FCC statistics applied to the adjusted data, a weighted s^2 is calculated for the BellSouth data as

$$s_{1A}^2 = \frac{\sum_j \sum_{i=1}^{n_{1j}} w_j (x_{1i} - \bar{x}_{1A})^2}{\sum_{j,i} w_j - 1}.$$

Recalling that the sum of the weights is n_2, in this case, the adjusted pooled variance for the FCC test is then

$$s_{pA}^2 = \frac{(n_2 - 1)(s_{1A}^2 + s_2^2)}{2n_2 - 2}.$$

Using the notation developed here, the tests shown in the main report are calculated as follows, where G indicates the total number of replicates used.

Summary of Calculations.

	Unadjusted Data	**Adjusted Data**
LCUG Test	$\frac{\bar{x}_1 - \bar{x}_2}{s_1\sqrt{1/n_1 + 1/n_2}}$	$\frac{\bar{x}_{1A} - \bar{x}_2}{s_{1A}\sqrt{2/n_2}}$
FCC Test	$\frac{\bar{x}_1 - \bar{x}_2}{s_p\sqrt{1/n_1 + 1/n_2}}$	$\frac{\bar{x}_{1A} - \bar{x}_2}{s_{pA}\sqrt{2/n_2}}$
BellSouth	$\frac{\bar{x}_1 - \bar{x}_2}{s_r/\sqrt{G}}$	$\frac{\bar{x}_{1A} - \bar{x}_2}{s_{rA}/\sqrt{G}}$

Performance Measured as a Proportion

If the performance measure is a proportion or a percentage of cases which possess some characteristic, such as the proportion of orders taking less than two days to finish, then these methods also apply. It may not be immediately obvious, but proportions can be placed in the same framework as sample means.

A proportion can be calculated by measuring a variable x_i for each case, where $x_i=1$ if the unit has the characteristic of interest (less than 2 days to complete, for example) and $x_i=0$ if the unit does not have the characteristic of interest. If we have n cases, then the proportion p of orders with the characteristic of interest is calculated as the mean of the x values, $\bar{x}$.

In this way, the tests can be formulated for proportions using the equations given in this appendix. For example, the sample means within classes become p_{1j} and p_{2j}, the proportion of BellSouth orders and CLEC orders, respectively, in class j. The adjusted estimate of the difference is then

$$\hat{D} = \sum_j n_{2j}(p_{1j} - p_{2j}) \Big/ n_2$$

Outline for the Proposed Replicate Data Analysis

The proposed BellSouth procedure is the replicate method applied to the adjusted data. The steps in the data analysis and test calculation that we propose can be summarized as follows:

1. Verify that we have the correct data set, by comparing to the published estimates on the BST internet website (https://clec.bellsouth.com).
2. Remove any additional data values that are not pertinent to analysis (official BellSouth orders for example)
3. If necessary, trim a very small proportion from the tail(s) of the distribution. (In some cases, the original BellSouth data procedure already included an upper or lower bound on data to be used for analysis.)
4. Put the replicate indicator on the data file and define the time classification.
5. Determine if there are other important classifications that should be used as well, such as order type.
6. For every class defined in steps 4 and 5, calculate the difference $d_j=\bar{x}_{1j} - \bar{x}_{2j}$. In one pass through the data files, a file can be built containing n_{2j}, n_{1j}, and d_j for all classes j.
7. From this data file, estimates of the difference in means and t-tests to test the hypothesis of nondiscriminatory treatment can be calculated for any level of aggregation at the LATA level and above.

Conclusions

The proposed replicate methodology compares "like to like" and it protects against failure of the assumptions of independence. The BellSouth procedure compares "like to like" by adjusting the BST distribution to be more similar to the CLEC distribution. It is not fair to compare CLEC results to BST orders that are intrinsically different. The bias due to the fact that the data come from an observational study makes a difference.

By respecting the business structure and using replicate variance estimates, the BellSouth procedure requires very few assumptions about the underlying distribution. In particular, it does not require the assumption that the observations are IID. In the Completion Order Provisioning examples in the main report, we saw that the adjustments and the use of the replicate variance estimate made a noticeable difference in the results. Not using the adjusted replicate method would have lead to very misleading results.

Insurance against model misspecification costs very little in this case. When the assumptions hold, there is a minimal loss in power using the replicate method compared to the FCC or LCUG method (2.04 vs 2.00 for the 5% two-sided significance level.) This is a small price to pay for a measure of protection against bias due to model misspecification. In addition, this procedure is of computationally modest cost to do routinely and it provides much flexibility in computing estimates and tests.

In conclusion, for these two measures and for other measures like them, the BellSouth adjusted replicate procedure should be highly successful and should be adopted. For a small price, it offers insurance against failure of the assumptions. And when the FCC and LCUG assumptions do hold, this method works just as well as they do. Even if a statistically significant difference is found, however, observational studies cannot assign cause. That is. a statistically significant difference in an observational study does not lead to a conclusion regarding discrimination without additional information.

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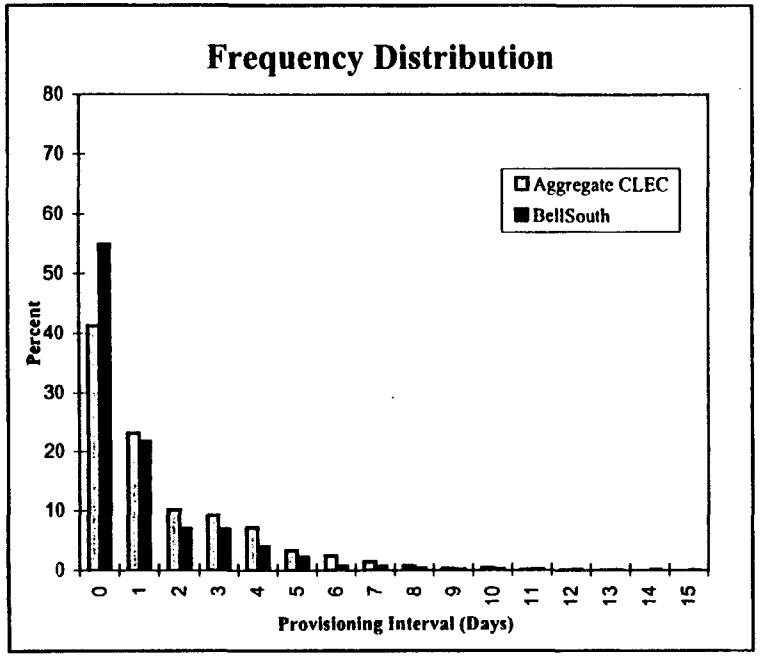
Appendix C
Order Completion Interval (OCI) - August Graphics

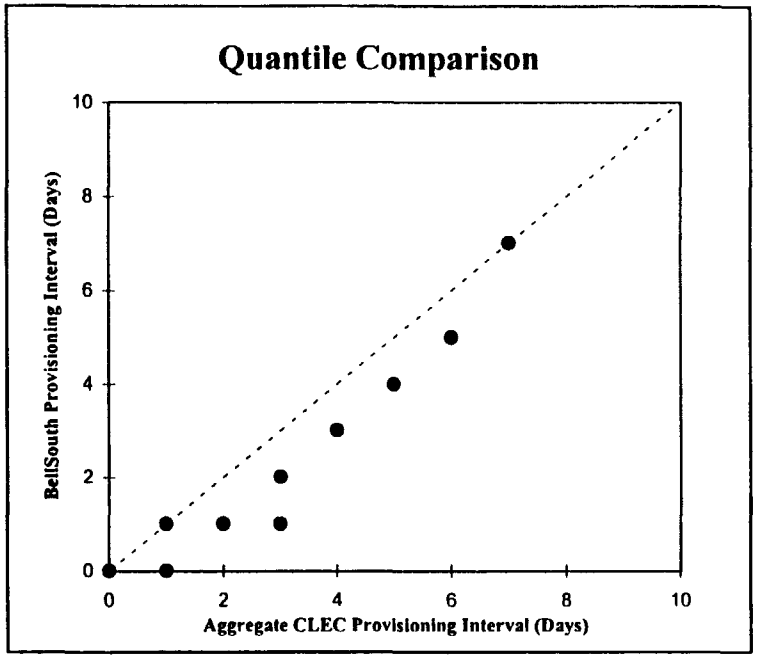
I. Graphical Representations

Unadjusted		Adjusted	
1. All Cases	C-1	12. All Cases	C-2
2. Dispatch Cases	C-3	13. Dispatch Cases	C-4
3. Non-Dispatch Cases	C-5	14. Non-Dispatch Cases	C-6
4. Dispatched, Residential, All Circuits	C-7	15. Dispatched, Residential, All Circuits	C-8
5. Dispatched, Business, All Circuits	C-9	16. Dispatched, Business, All Circuits	C-10
6. Non-Dispatched, Residential, All Circuits	C-11	17. Non-Dispatched, Residential, All Circuits	C-12
7. Non-Dispatched, Business, All Circuits	C-13	18. Non-Dispatched, Business, All Circuits	C-14
8. Dispatched, Residential, Less Than 10 Circuits	C-15	19. Dispatched, Residential, Less Than 10 Circuits	C-16
9. Dispatched, Business, Less Than 10 Circuits	C-17	20. Dispatched, Business, Less Than 10 Circuits	C-18
10. Non-Dispatched, Residential, Less Than 10 Circuits	C-19	21. Non-Dispatched, Residential, Less Than 10 Circuits	C-20
11. Non-Dispatched, Business, Less Than 10 Circuits	C-21	22. Non-Dispatched, Business, Less Than 10 Circuits	C-22

II. SQM C-23

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
All Cases





Descriptive Measures

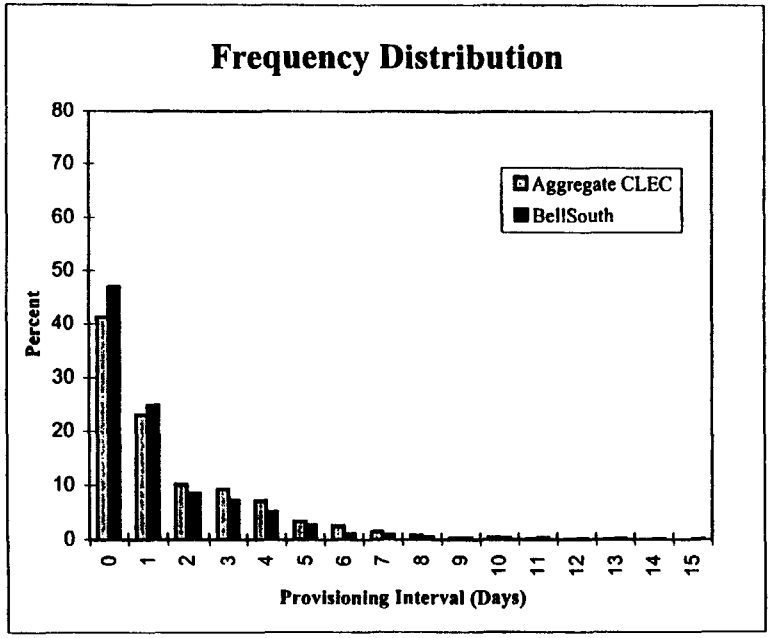
Service Provider	Mean	Standard Deviation
BST	1.20	2.78
CLEC	1.62	2.26
Difference	-0.42	

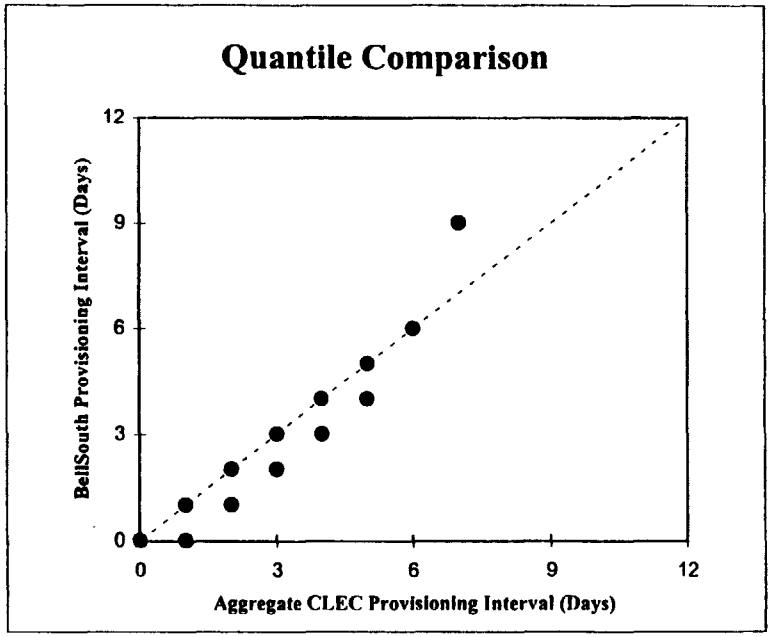
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-18.70	0.0000
FCC	-18.83	0.0000
BST	-9.02	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
All Cases





Descriptive Measures

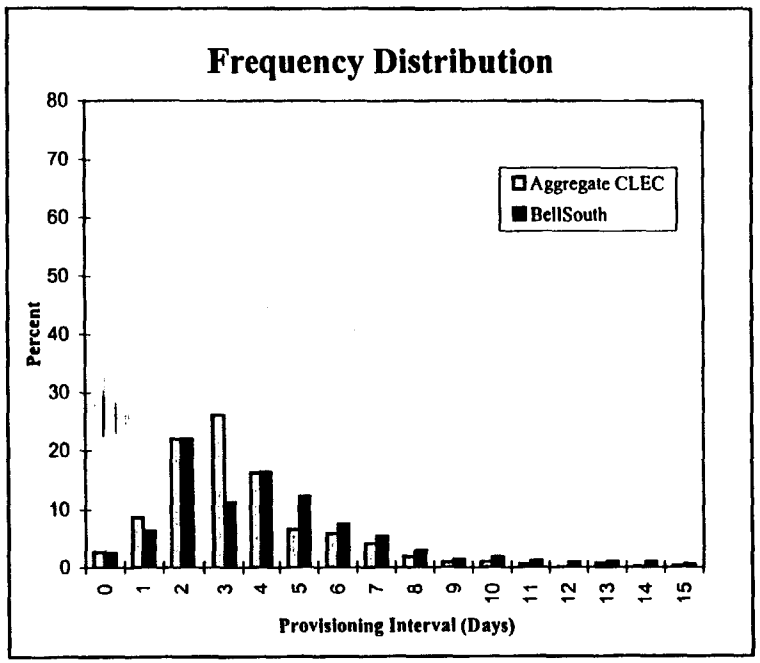
Service Provider	Mean	Standard Deviation
BST	1.48	2.95
CLEC	1.62	2.26
Difference	-0.14	

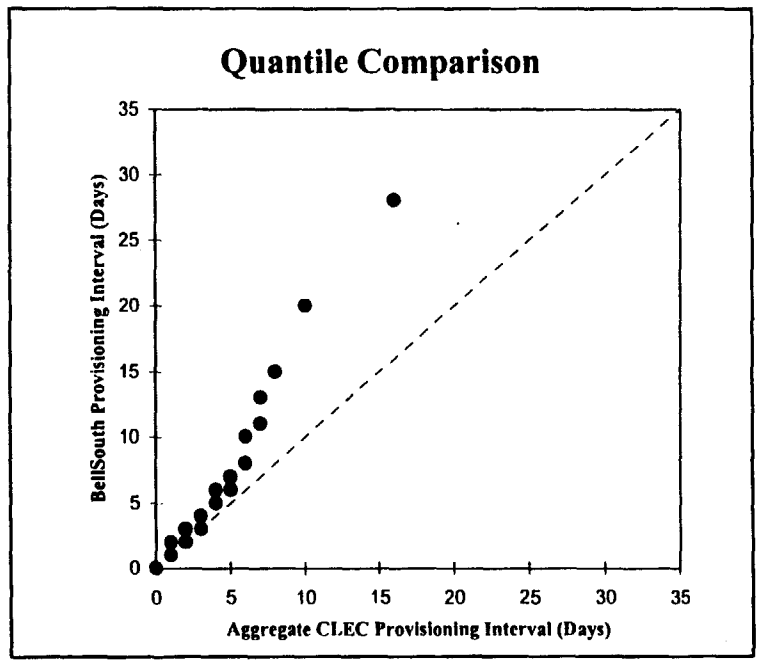
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-6.08	0.0000
FCC	-6.13	0.0000
BST	-2.57	0.7774

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched Cases





Descriptive Measures

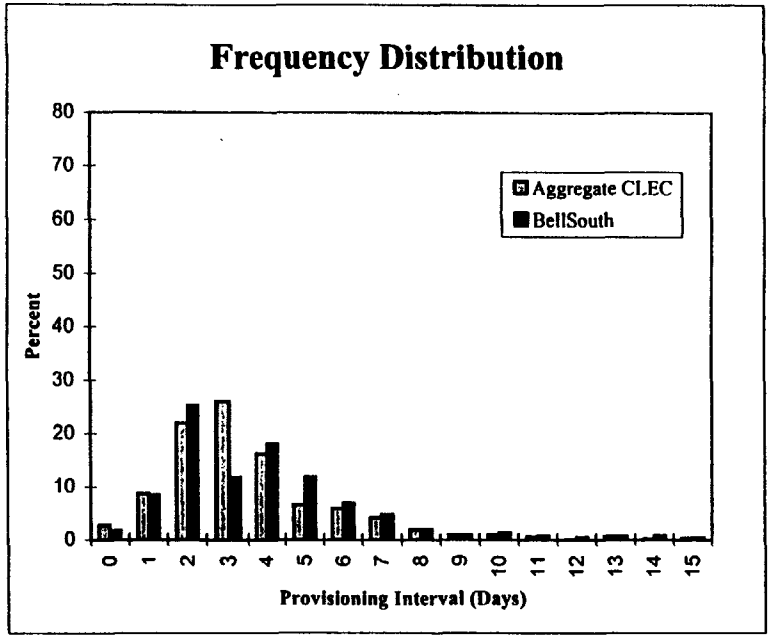
Service Provider	Mean	Standard Deviation
BST	5.70	7.14
CLEC	3.99	3.77
Difference	1.71	

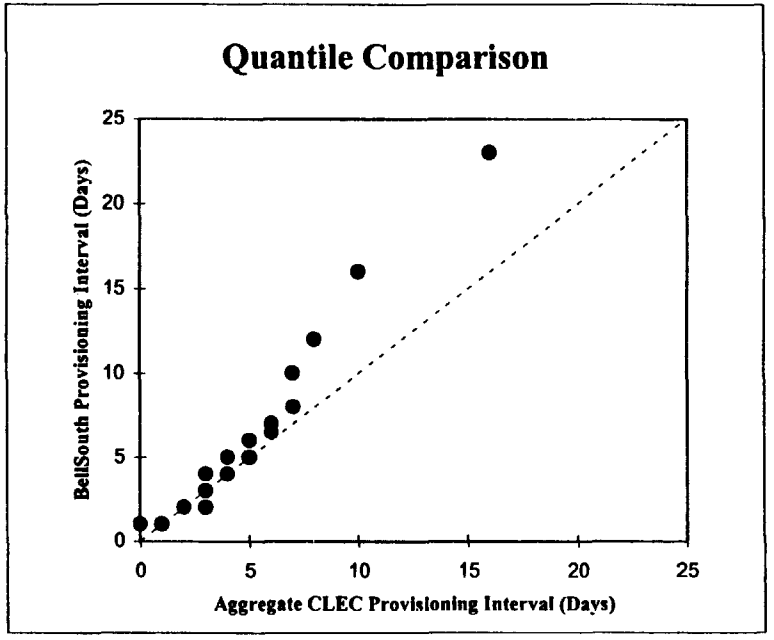
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	8.37	0.0000
FCC	8.53	0.0000
BST	7.13	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched Cases





Descriptive Measures

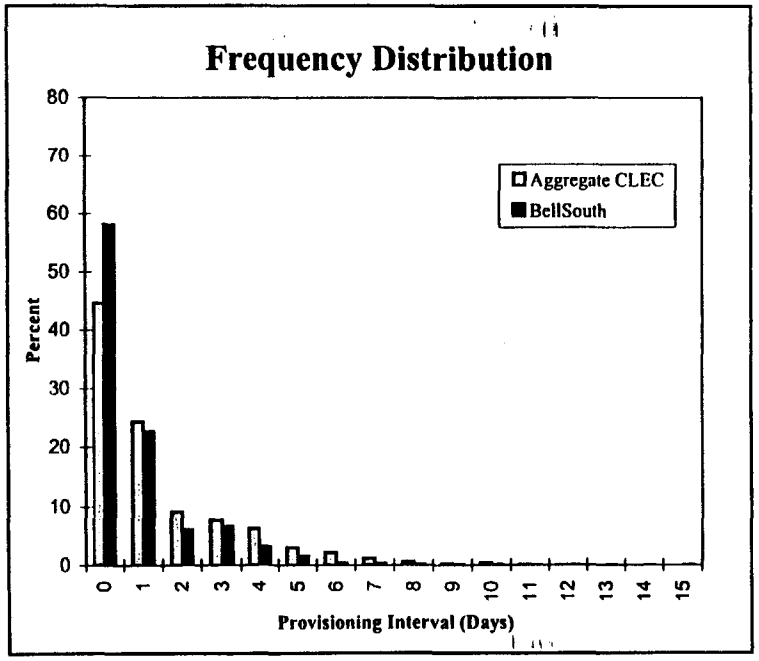
Service Provider	Mean	Standard Deviation
BST	4.88	5.84
CLEC	3.99	3.77
Difference	0.89	

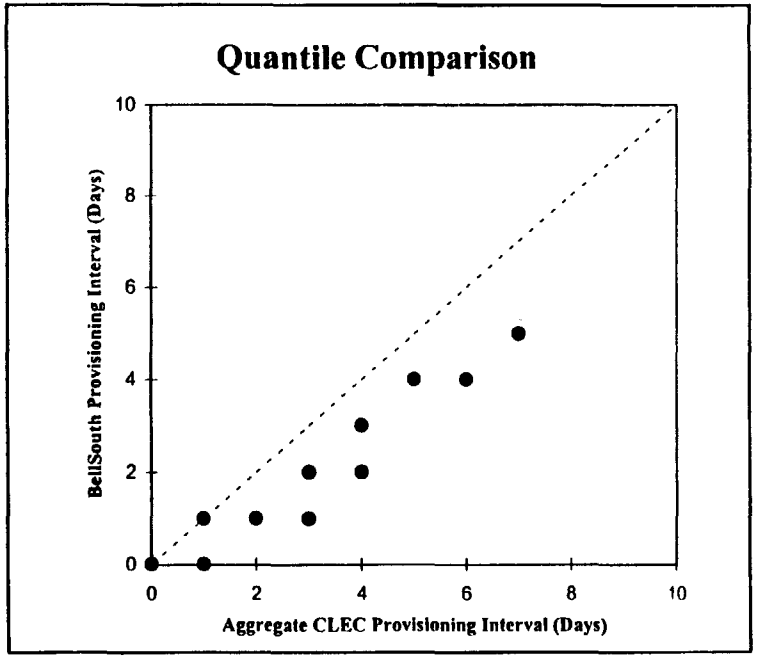
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.34	0.0000
FCC	5.42	0.0000
BST	6.41	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched Cases





Descriptive Measures

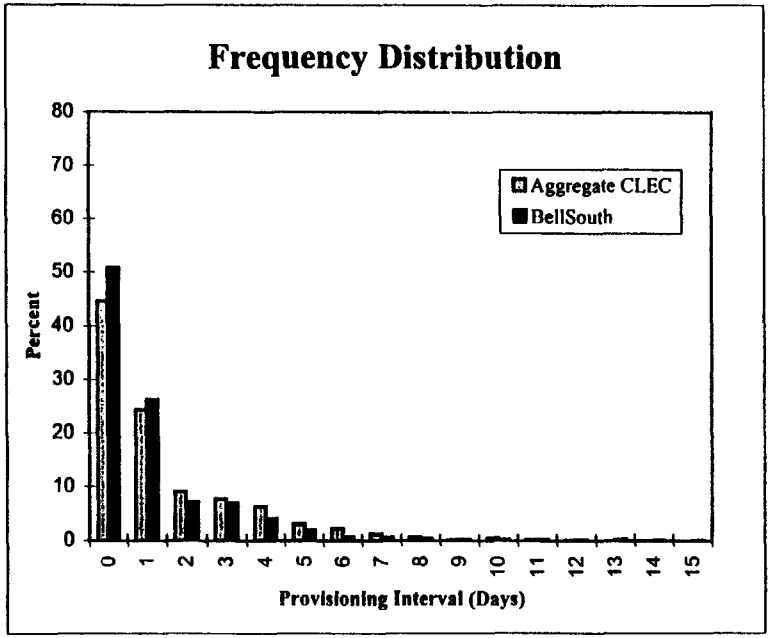
Service Provider	Mean	Standard Deviation
BST	0.92	1.93
CLEC	1.41	1.94
Difference	-0.49	

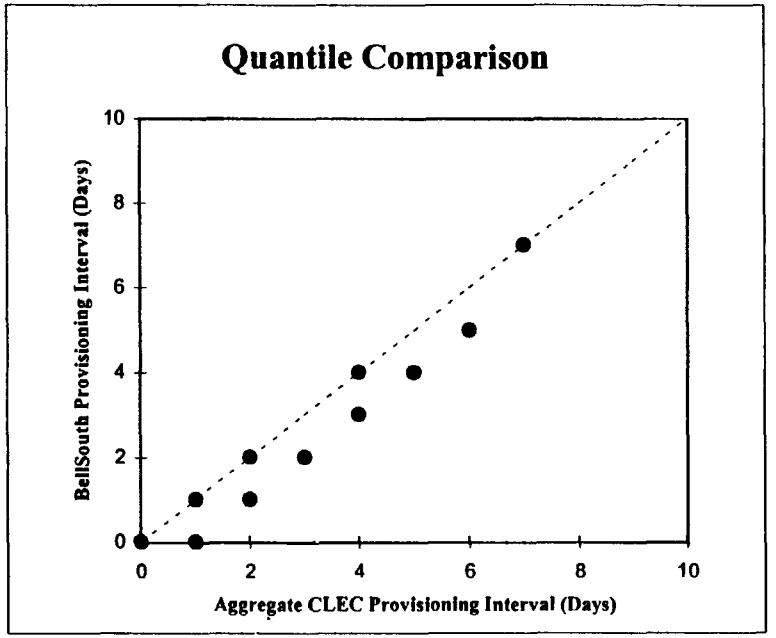
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-30.41	0.0000
FCC	-30.41	0.0000
BST	-10.93	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched Cases





Descriptive Measures

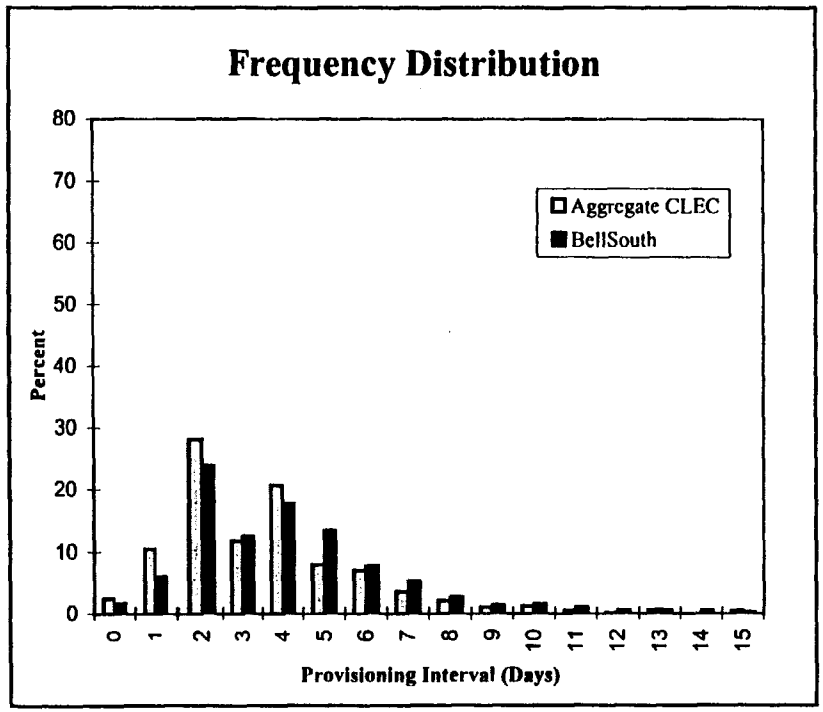
Service Provider	Mean	Standard Deviation
BST	1.18	2.33
CLEC	1.41	1.94
Difference	-0.23	

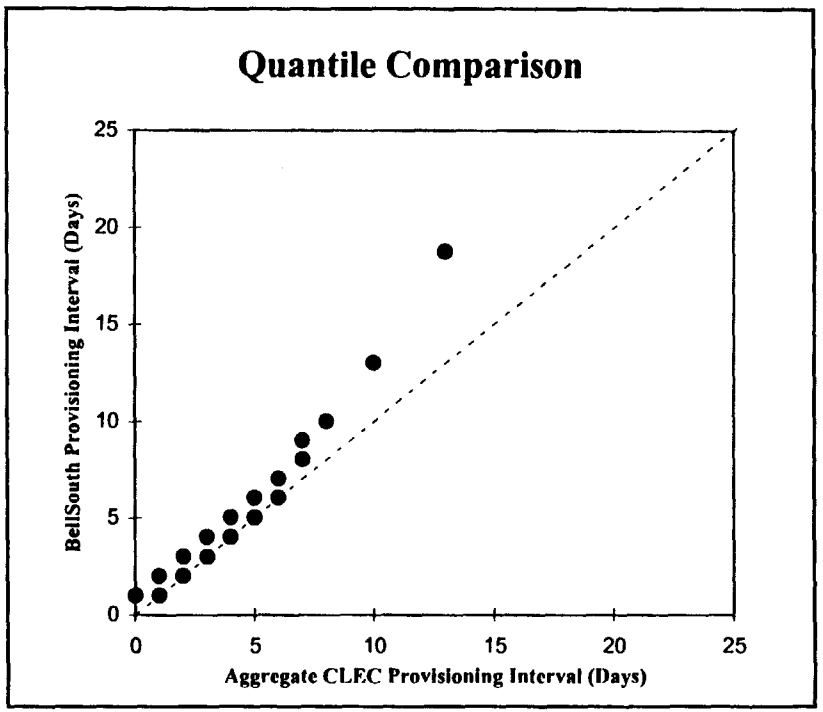
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-11.86	0.0000
FCC	-11.93	0.0000
BST	-4.39	0.0068

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, All Circuits





Descriptive Measures

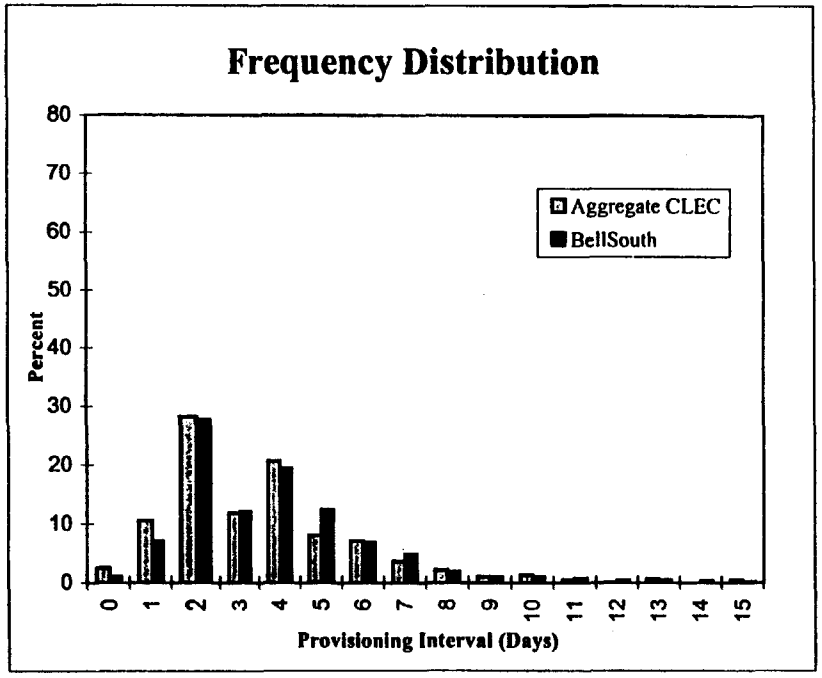
Service Provider	Mean	Standard Deviation
BST	4.69	4.45
CLEC	3.84	3.38
Difference	0.85	

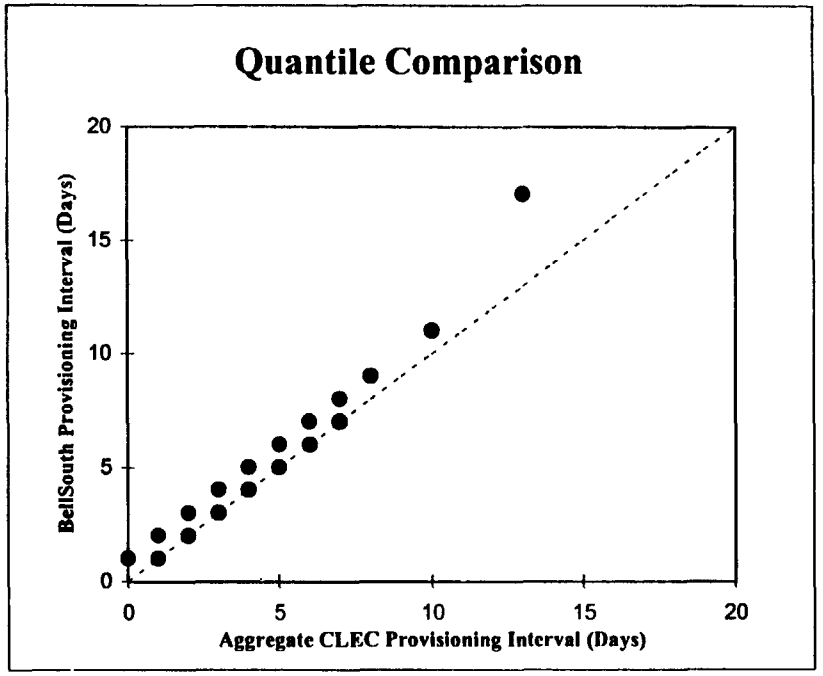
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.77	0.0000
FCC	5.83	0.0000
BST	8.67	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, All Circuits





Descriptive Measures

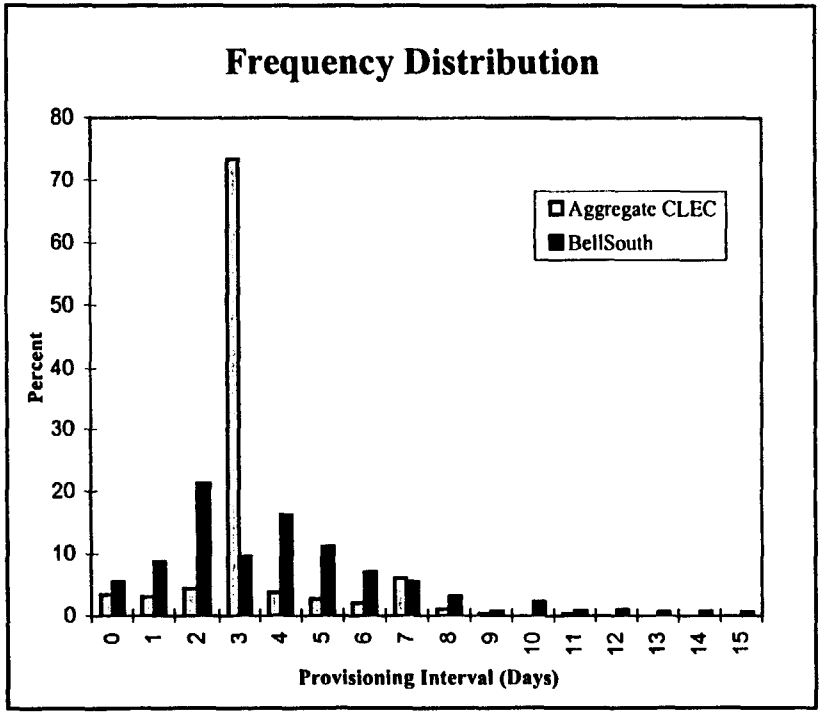
Service Provider	Mean	Standard Deviation
BST	4.34	4.19
CLEC	3.84	3.38
Difference	0.50	

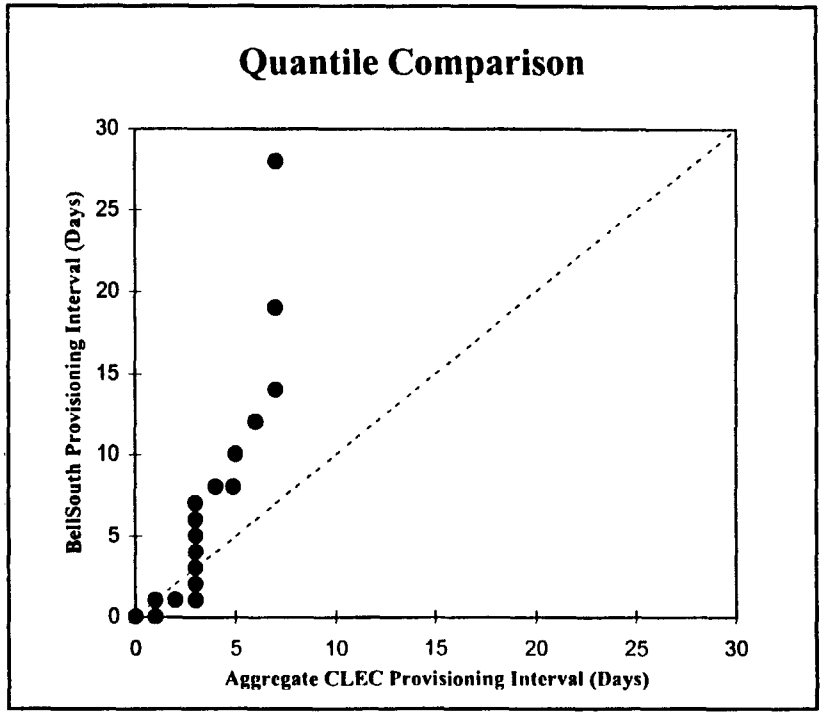
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	3.60	0.0159
FCC	3.63	0.0139
BST	4.40	0.0067

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, All Circuits





Descriptive Measures

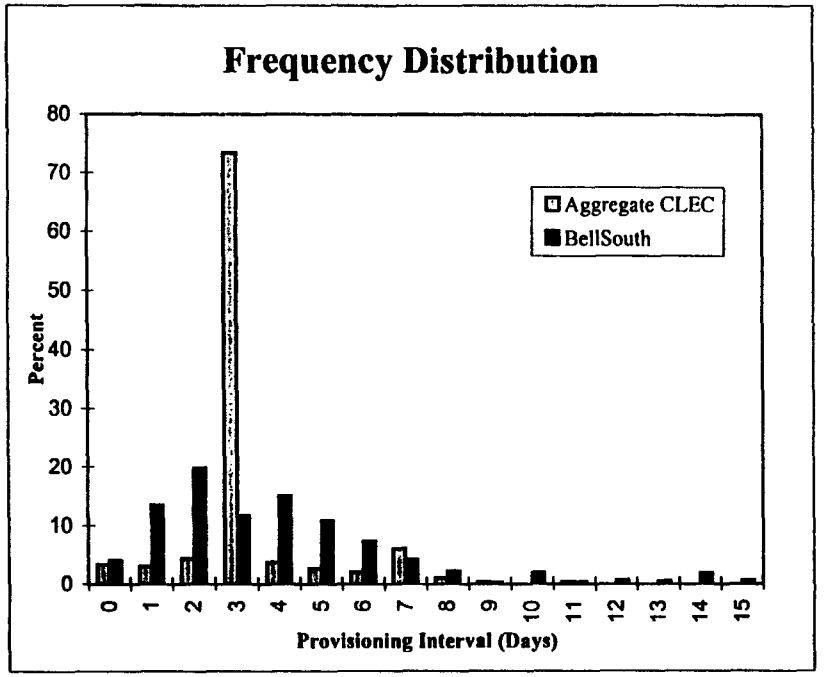
Service Provider	Mean	Standard Deviation
BST	5.37	7.34
CLEC	3.28	1.50
Difference	2.09	

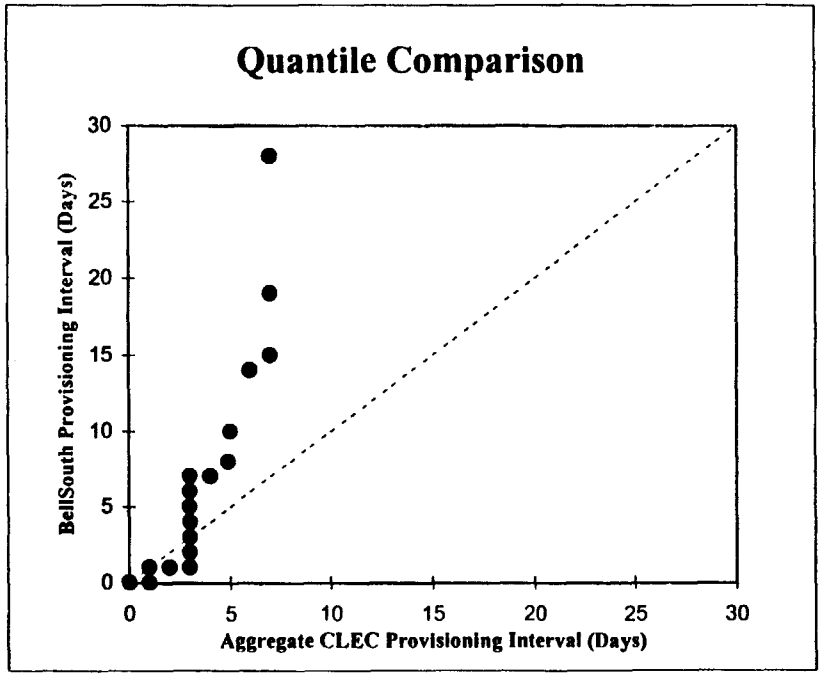
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	4.81	0.0001
FCC	4.93	0.0000
BST	8.86	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, All Circuits





Descriptive Measures

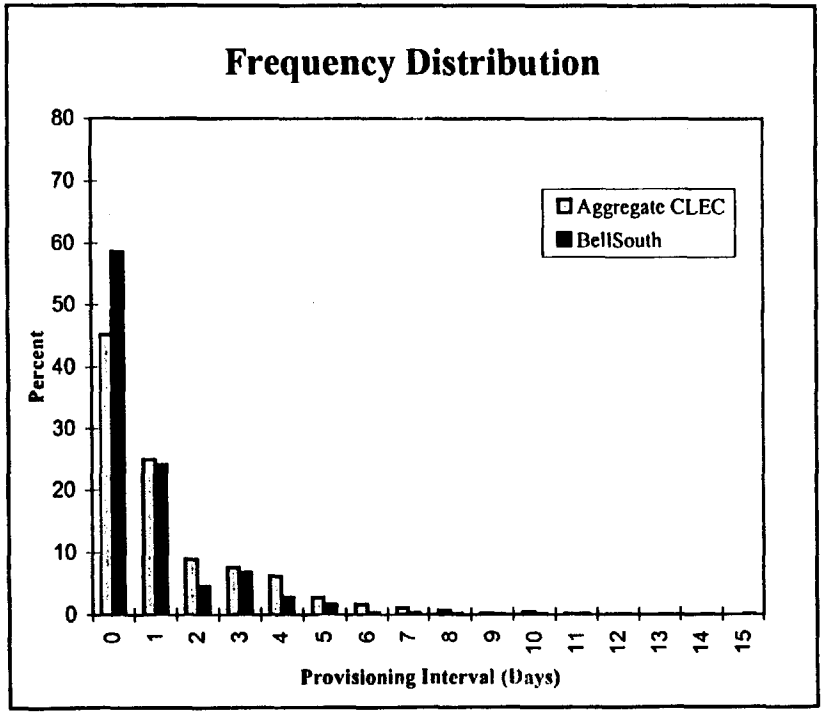
Service Provider	Mean	Standard Deviation
BST	5.27	7.25
CLEC	3.28	1.50
Difference	1.99	

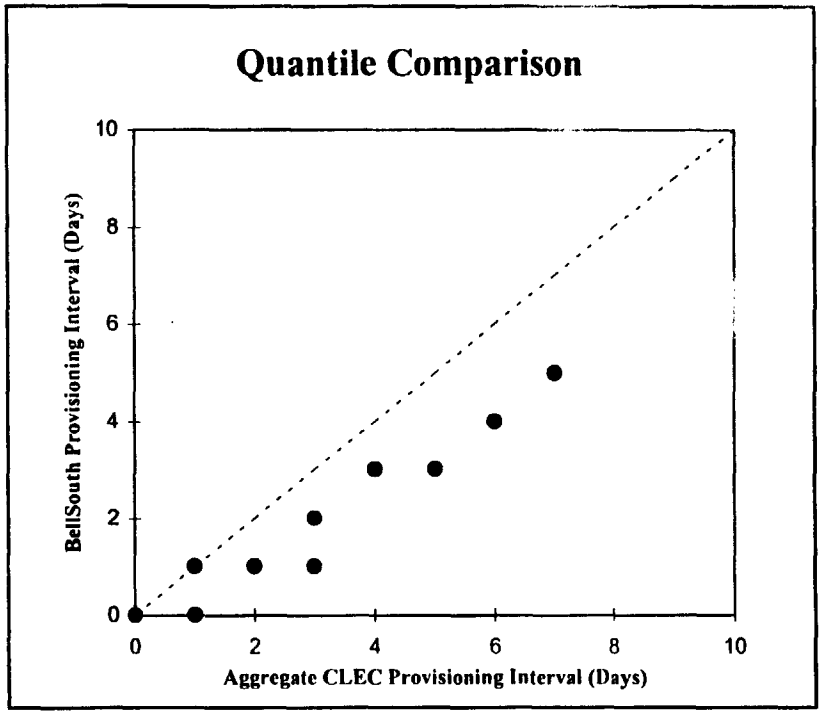
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	4.63	0.0002
FCC	4.75	0.0001
BST	2.48	0.9762

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, All Circuits





Descriptive Measures

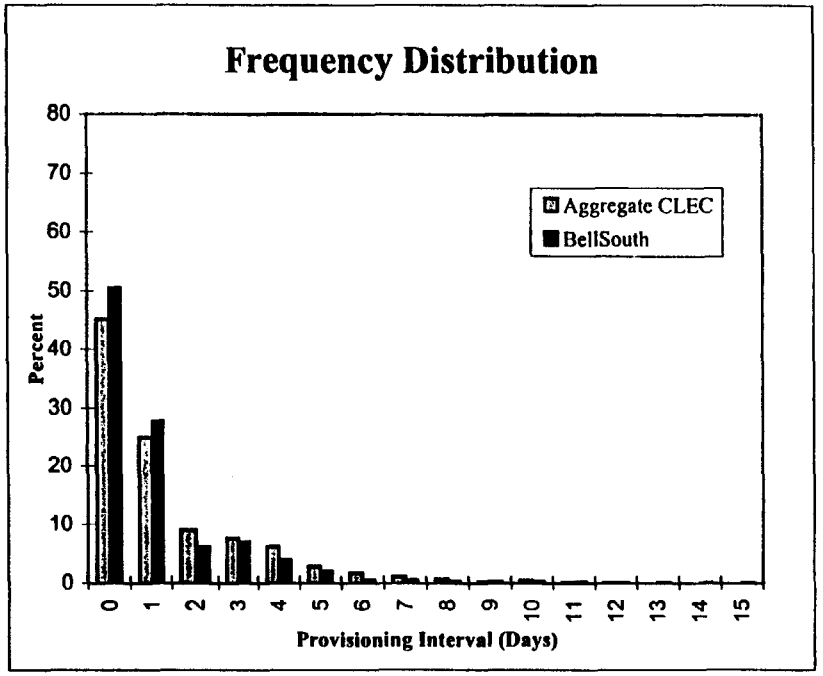
Service Provider	Mean	Standard Deviation
BST	0.88	1.83
CLEC	1.35	1.87
Difference	-0.47	

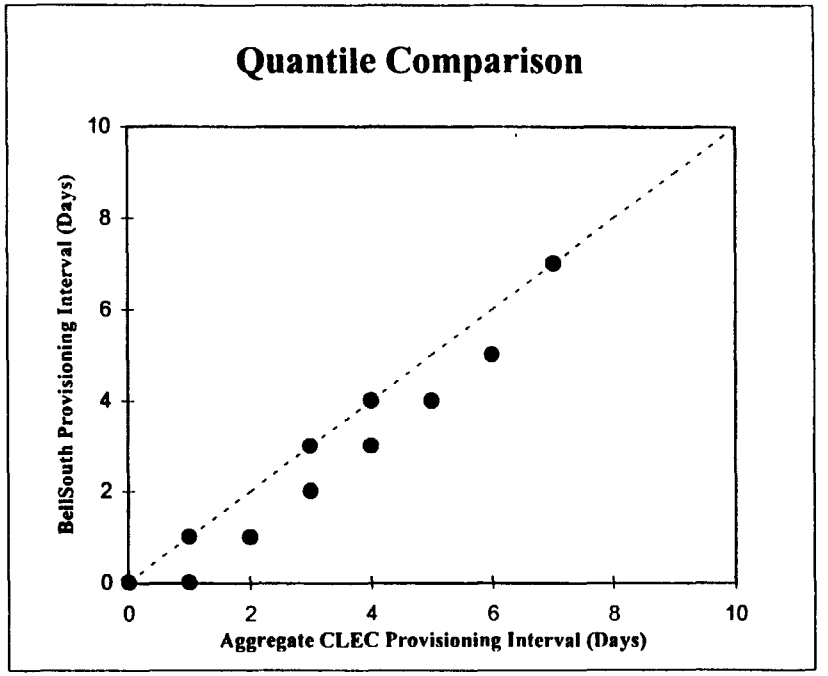
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-29.48	0.0000
FCC	-29.46	0.0000
BST	-10.05	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, All Circuits





Descriptive Measures

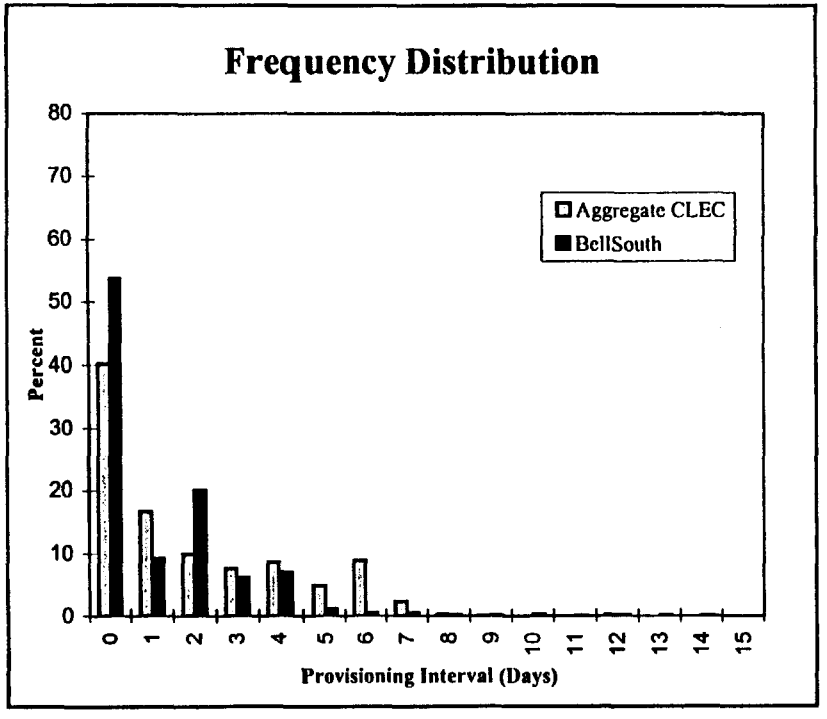
Service Provider	Mean	Standard Deviation
BST	1.15	2.26
CLEC	1.35	1.87
Difference	-0.20	

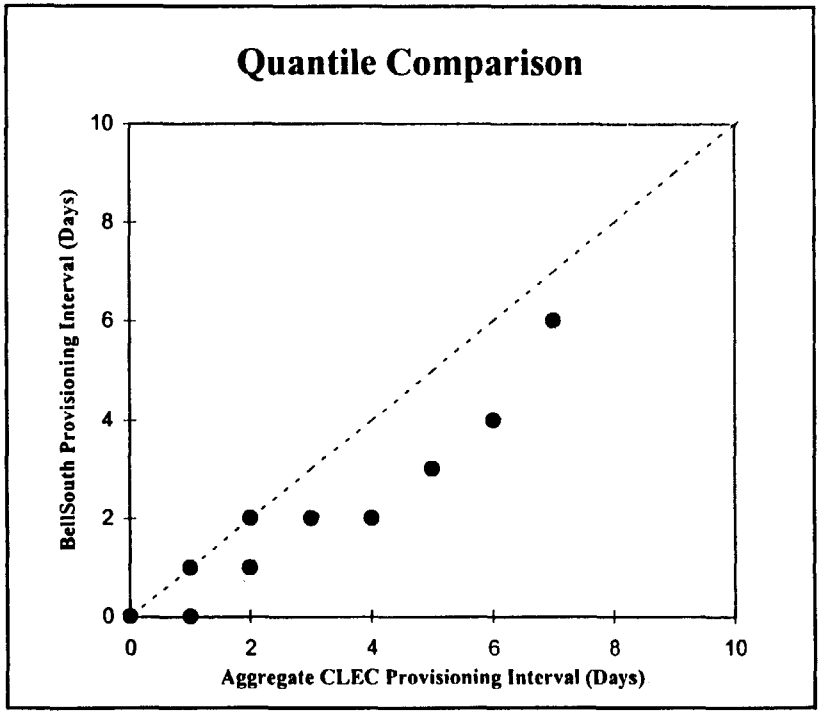
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-10.38	0.0000
FCC	-10.44	0.0000
BST	-4.41	0.0066

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, All Circuits





Descriptive Measures

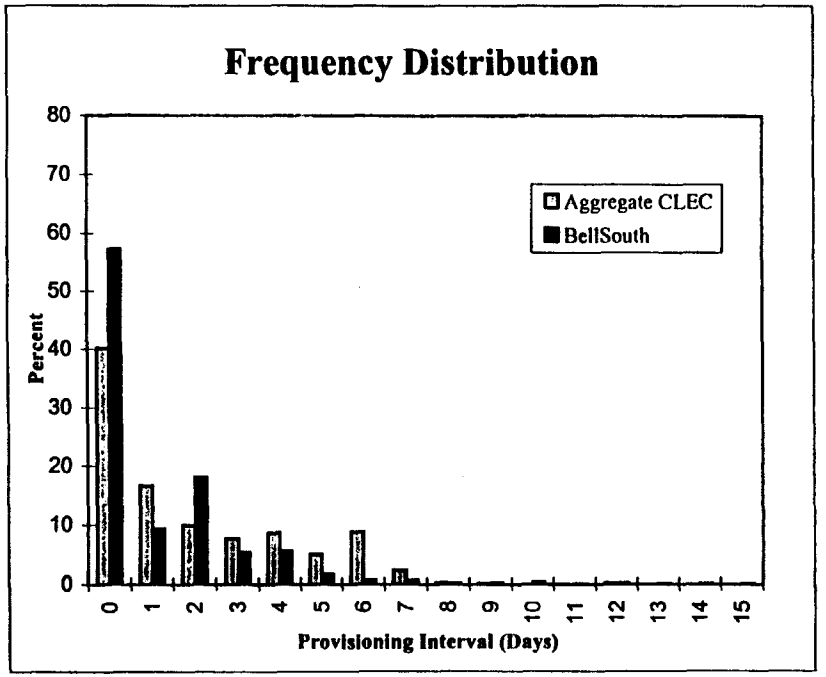
Service Provider	Mean	Standard Deviation
BST	1.28	2.65
CLEC	1.98	2.37
Difference	-0.70	

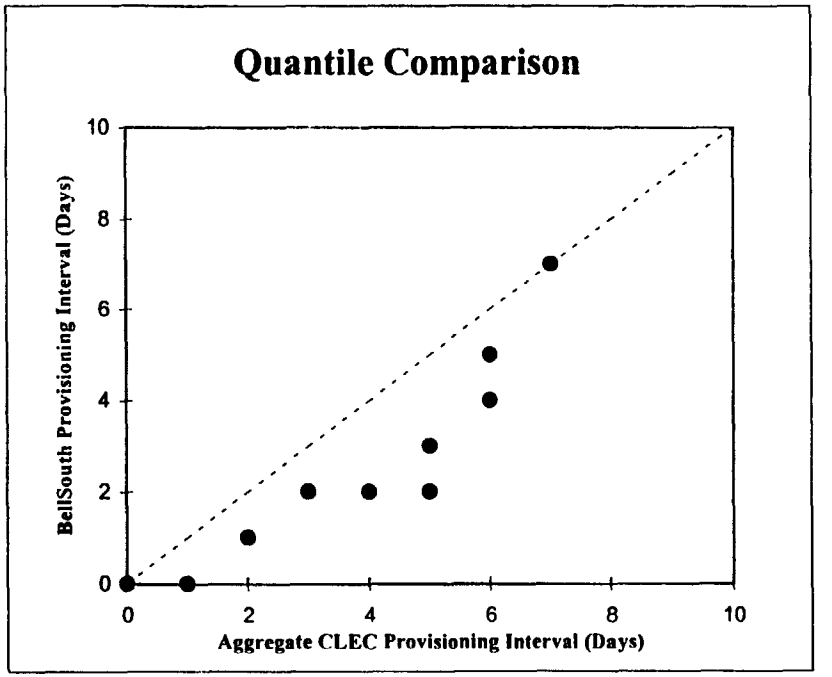
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-8.69	0.0000
FCC	-8.72	0.0000
BST	-3.12	0.2098

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, All Circuits





Descriptive Measures

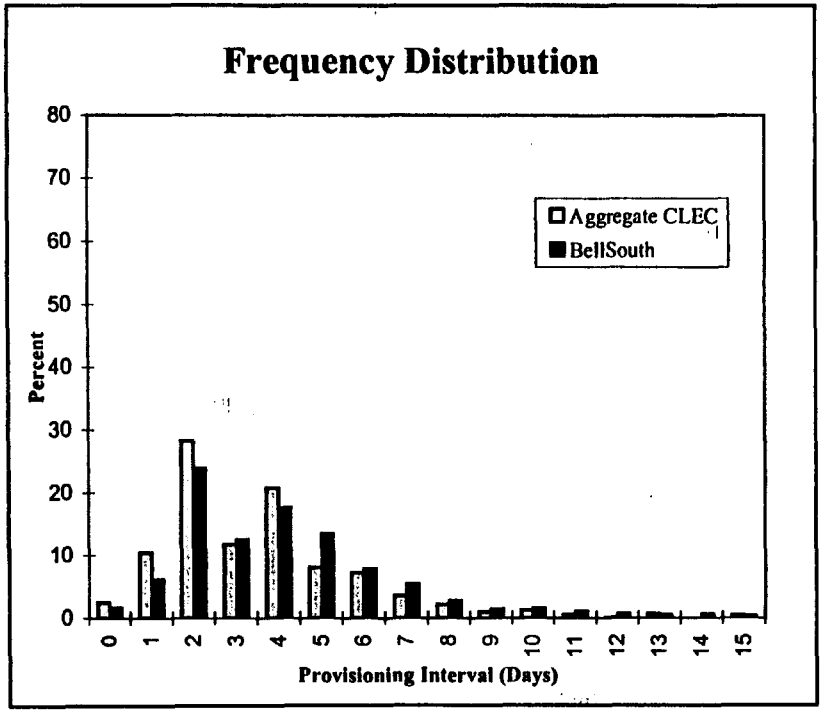
Service Provider	Mean	Standard Deviation
BST	1.20	2.47
CLEC	1.98	2.37
Difference	-0.78	

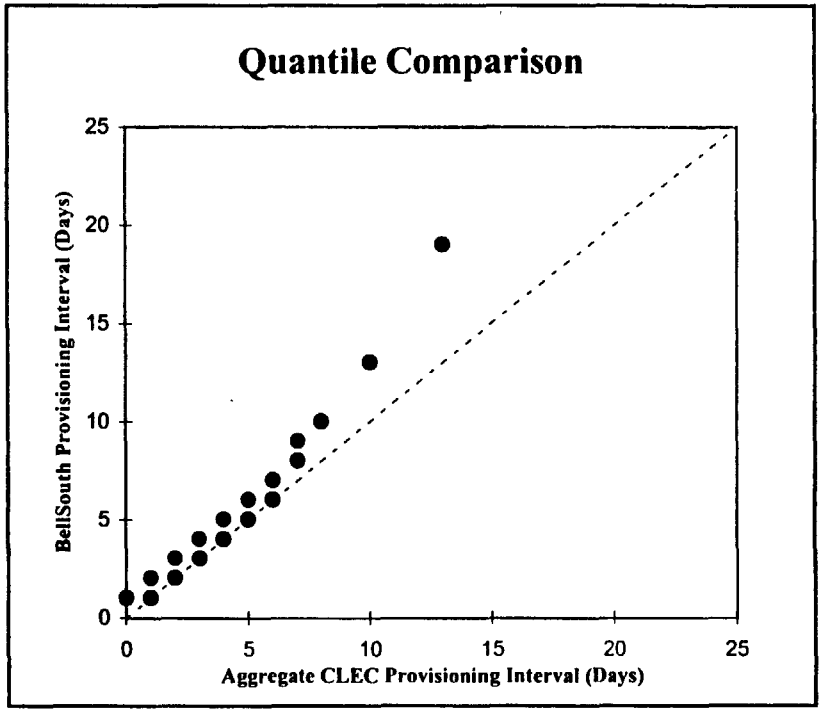
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-10.42	0.0000
FCC	-10.43	0.0000
BST	-3.55	0.0686

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

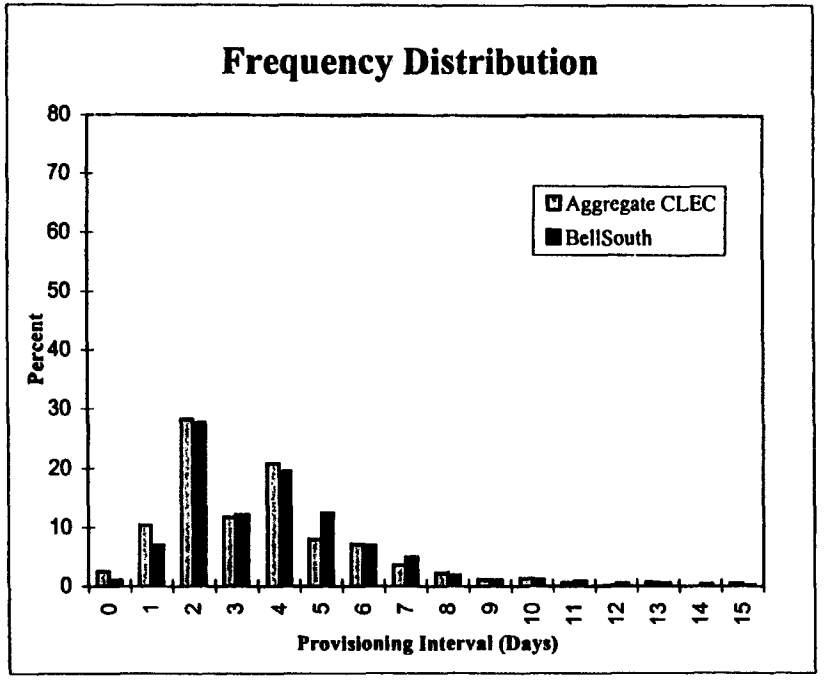
Service Provider	Mean	Standard Deviation
BST	4.70	4.45
CLEC	3.85	3.39
Difference	0.85	

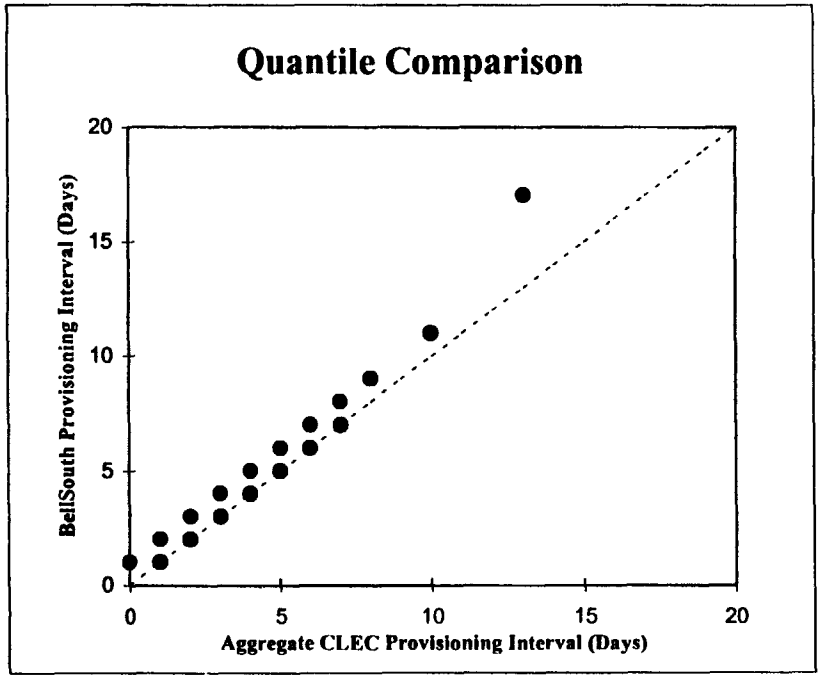
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.73	0.0000
FCC	5.79	0.0000
BST	8.69	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

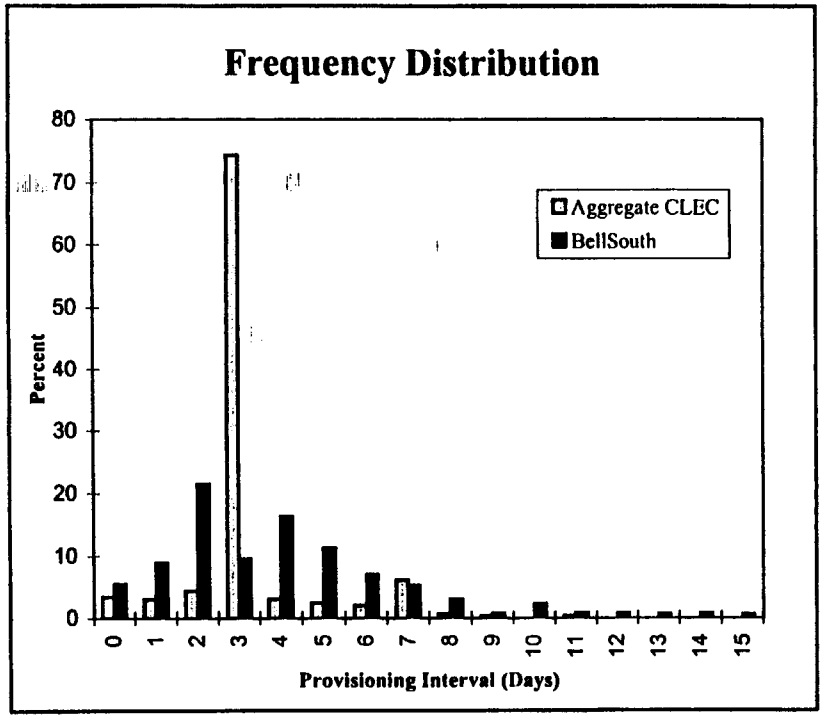
Service Provider	Mean	Standard Deviation
BST	4.34	4.17
CLEC	3.85	3.39
Difference	0.49	

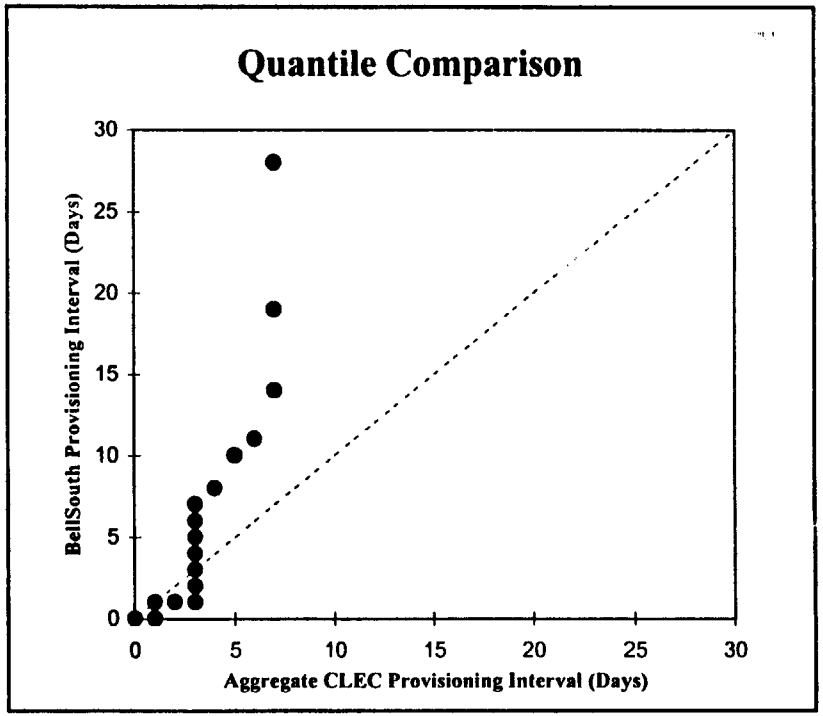
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	3.53	0.0210
FCC	3.56	0.0185
BST	4.40	0.0068

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

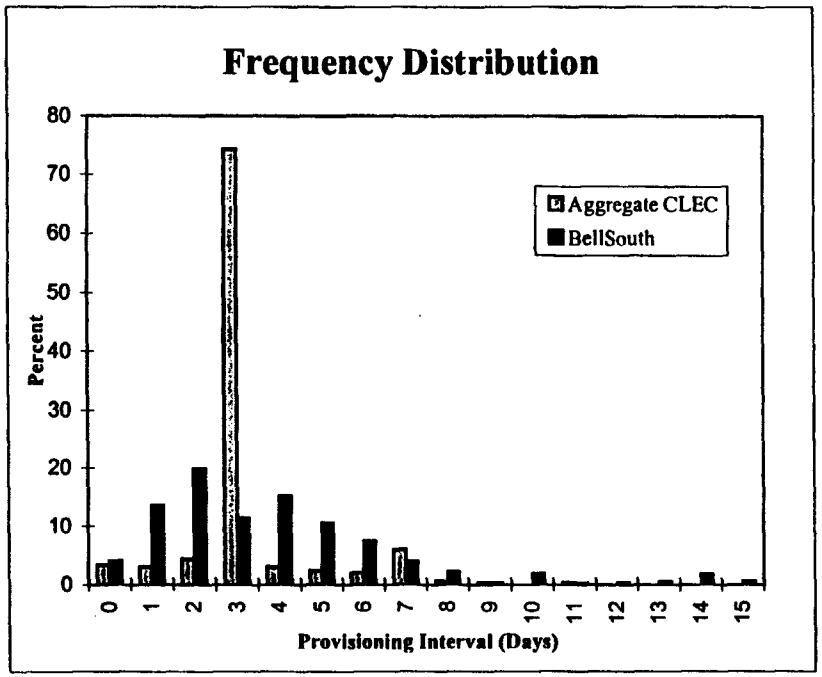
Service Provider	Mean	Standard Deviation
BST	5.31	7.18
CLEC	3.26	1.48
Difference	2.05	

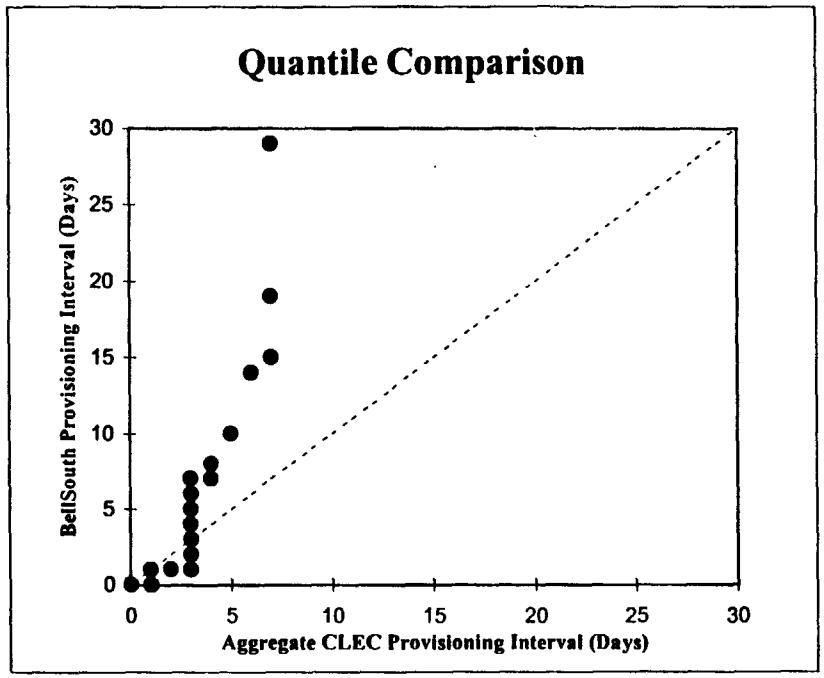
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	4.78	0.0001
FCC	4.91	0.0000
BST	8.67	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

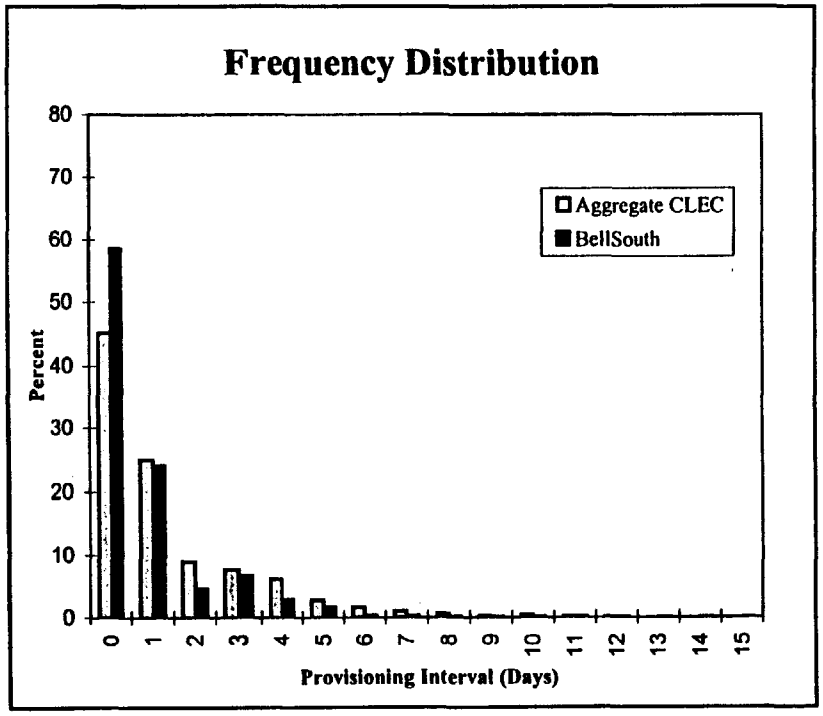
Service Provider	Mean	Standard Deviation
BST	5.26	7.29
CLEC	3.26	1.48
Difference	2.00	

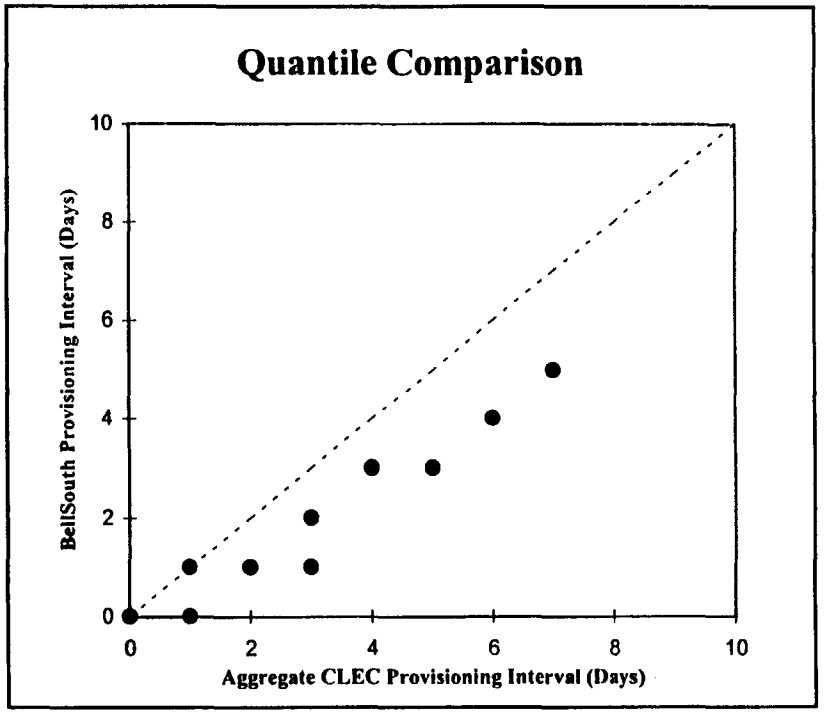
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	4.59	0.0002
FCC	4.71	0.0001
BST	2.50	0.9451

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	0.88	1.83
CLEC	1.35	1.87
Difference	-0.47	

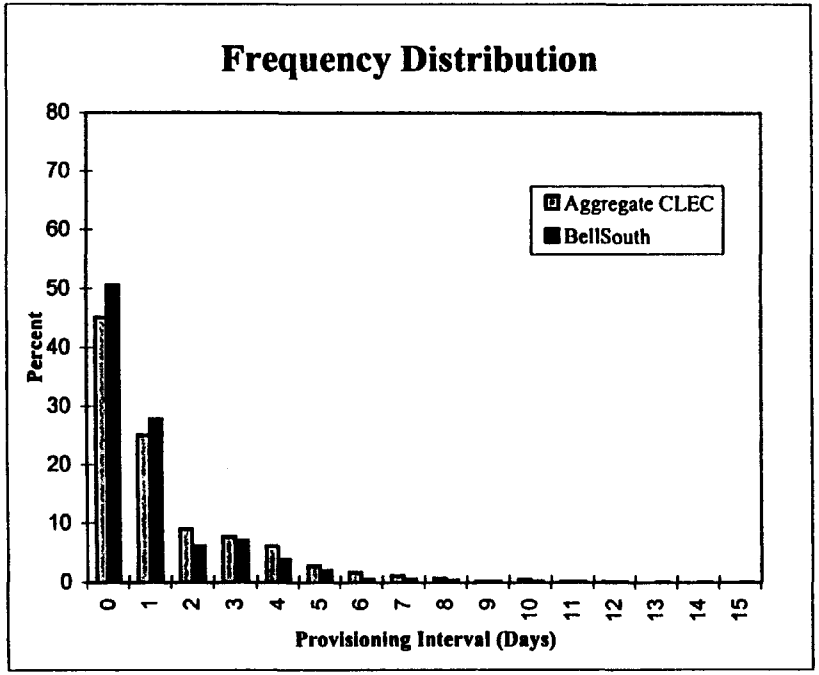
Analytic Measures

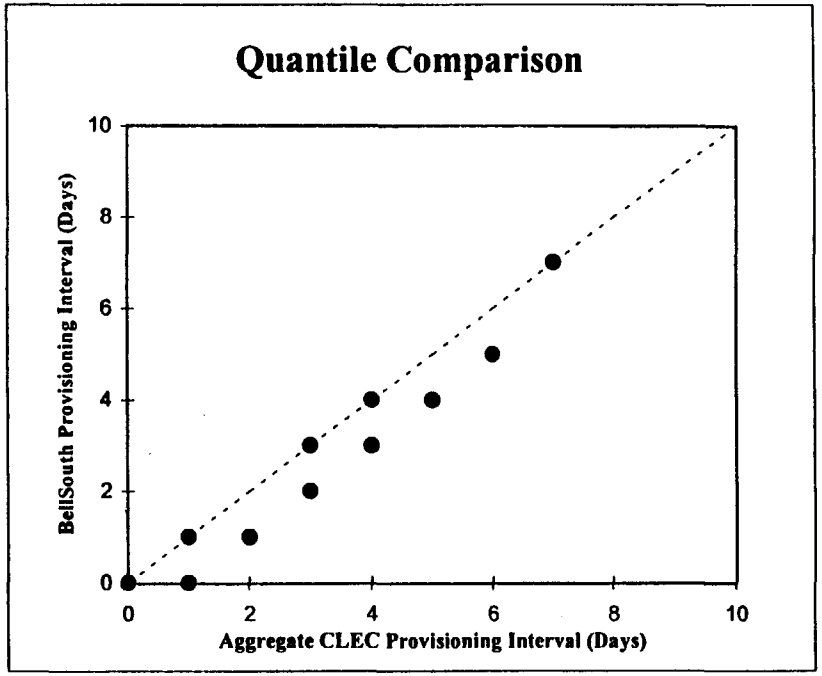
Testing Method	Test Statistic	P-value (percent)
LCUG	-29.48	0.0000
FCC	-29.46	0.0000
BST	-10.05	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.

The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

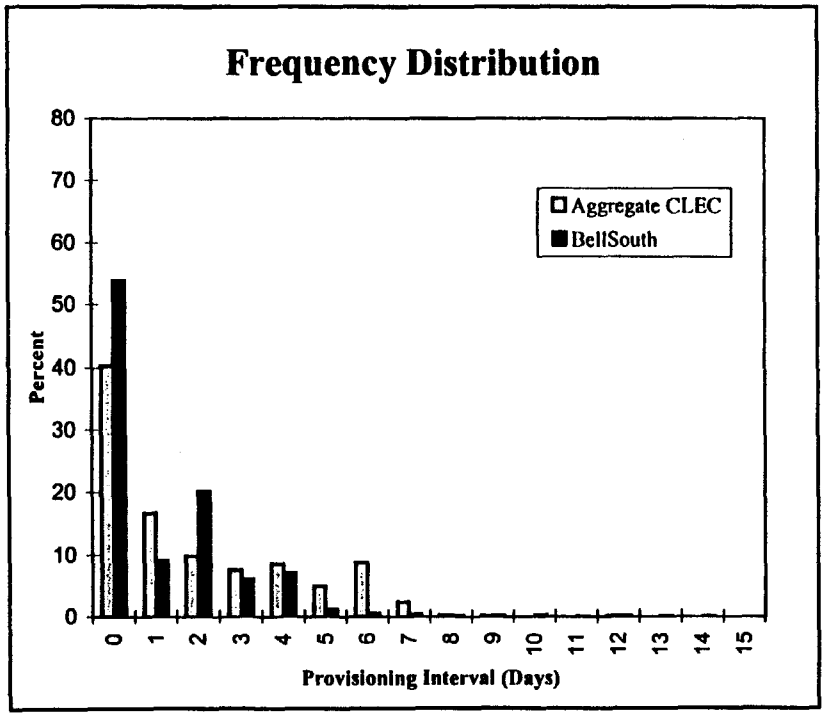
Service Provider	Mean	Standard Deviation
BST	1.15	2.26
CLEC	1.35	1.87
Difference	-0.20	

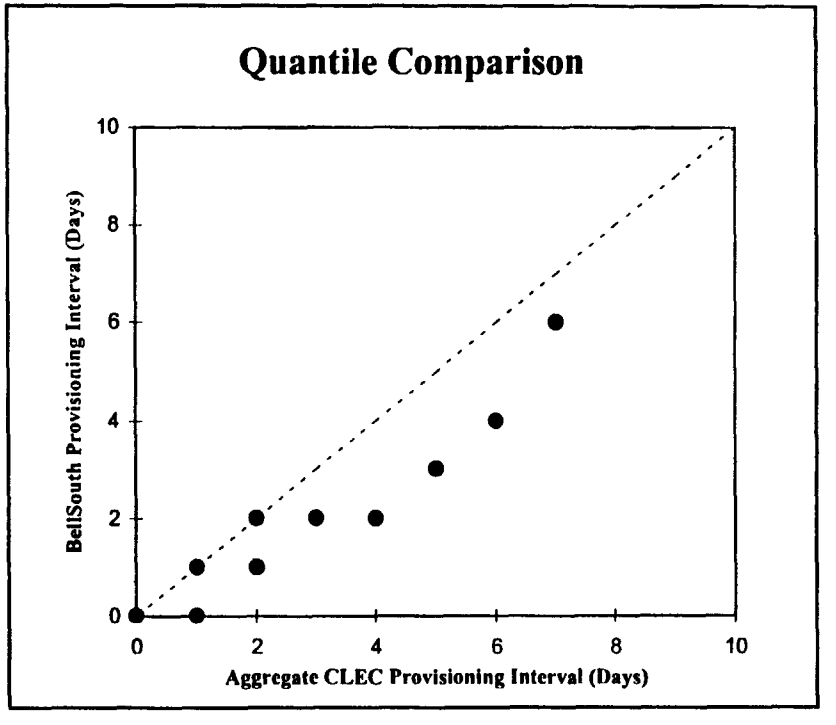
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-10.38	0.0000
FCC	-10.44	0.0000
BST	-4.41	0.0066

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

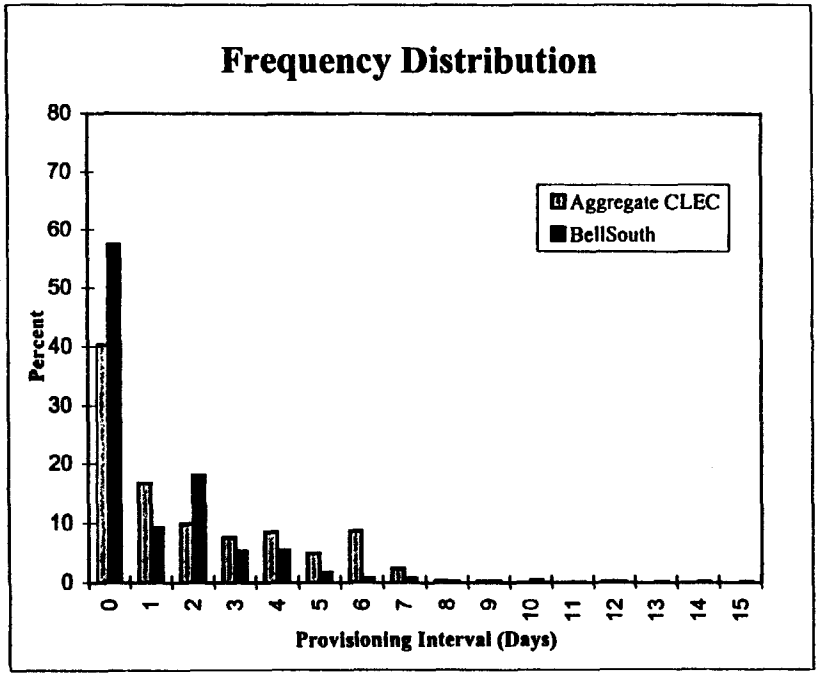
Service Provider	Mean	Standard Deviation
BST	1.28	2.65
CLEC	1.97	2.37
Difference	-0.69	

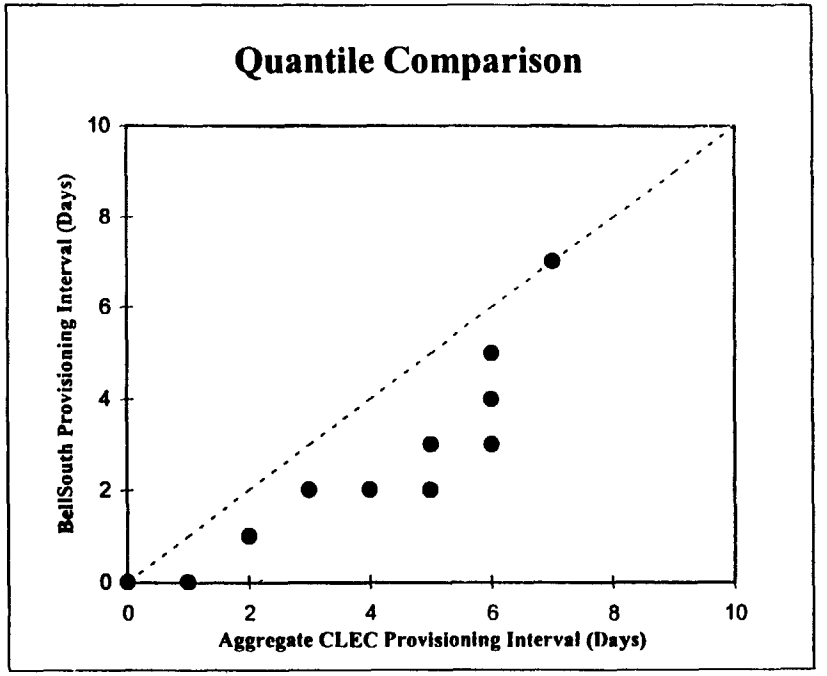
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-8.58	0.0000
FCC	-8.61	0.0000
BST	-3.12	0.2098

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	1.19	2.46
CLEC	1.97	2.37
Difference	-0.78	

Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-10.44	0.0000
FCC	-10.46	0.0000
BST	-3.57	0.0660

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

SQM: Order Completion Interval

AUGUST

	DISPATCH															
	SAME DAY		1 DAY		2 DAYS		3 DAYS		4 DAYS		5 DAYS		> 5 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE RESIDENCE	2.64%	0.00%	9.99%	25.00%	26.84%	12.50%	12.14%	12.50%	19.69%	0.00%	7.84%	12.50%	20.86%	37.50%	4.09	5.00
- RESALE BUSINESS	3.17%	0.00%	2.86%	0.00%	5.08%	0.00%	70.79%	16.67%	3.49%	33.33%	2.86%	16.67%	11.75%	33.33%	3.81	5.83
- UNE LOOPS WITH LNP																
BST																
LOUISIANA																
- RETAIL RESIDENCE	2.30%	1.63%	5.94%	4.88%	21.54%	26.02%	11.75%	13.01%	16.19%	19.51%	12.63%	8.94%	29.66%	26.02%	5.38	4.69
- RETAIL BUSINESS	5.05%	0.68%	8.04%	3.42%	18.87%	9.59%	9.09%	11.64%	14.40%	7.53%	10.21%	6.16%	34.34%	60.96%	7.37	15.29

	DISPATCH															
	0-5 DAYS		6-10 DAYS		11-15 DAYS		16-20 DAYS		21-25 DAYS		26-30 DAYS		> 30 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE DESIGN	8.77%	0.00%	12.28%	0.00%	15.79%	0.00%	15.79%	66.67%	15.79%	0.00%	19.30%	0.00%	12.28%	33.33%	19.70	23.33
- UNE DESIGN	21.05%	100.00%	33.33%	0.00%	21.05%	0.00%	17.54%	0.00%	5.26%	0.00%	1.75%	0.00%	0.00%	0.00%	10.86	2.00
- UNE NON-DESIGN	35.56%	0.00%	35.56%	0.00%	6.67%	0.00%	13.33%	0.00%	0.00%	0.00%	2.22%	0.00%	6.67%	0.00%	10.18	0.00
BST																
LOUISIANA																
- RETAIL DESIGN	10.91%	0.00%	18.21%	20.00%	19.38%	20.00%	11.45%	0.00%	12.17%	20.00%	5.50%	0.00%	22.40%	40.00%	23.00	31.80

Definitions

issue date -- Date service order is entered into the system (not necessarily same as application date)

completion date -- Date on which service order is completed

order completion interval -- computed as order completion interval = completion date - issue date

SQM: Order Completion Interval

AUGUST

	NO DISPATCH															
	SAME DAY		1 DAY		2 DAYS		3 DAYS		4 DAYS		5 DAYS		> 5 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE RESIDENCE	44.84%	0.00%	24.94%	0.00%	9.08%	0.00%	7.95%	0.00%	6.20%	0.00%	2.81%	0.00%	4.18%	0.00%	1.38	0.00
- RESALE BUSINESS	40.00%	0.00%	17.32%	0.00%	10.54%	20.00%	7.78%	20.00%	8.12%	20.00%	5.02%	0.00%	11.21%	40.00%	1.93	4.20
- UNE LOOPS WITH LNP																
BST																
LOUISIANA																
- RETAIL RESIDENCE	58.29%	0.00%	24.08%	0.00%	4.66%	0.00%	6.80%	0.00%	2.89%	0.00%	1.67%	0.00%	1.62%	0.00%	0.92	0.00
- RETAIL BUSINESS	64.32%	26.88%	9.88%	18.28%	13.88%	4.30%	4.34%	15.05%	4.92%	7.53%	0.84%	2.15%	1.83%	25.81%	1.05	7.27

	NO DISPATCH															
	0-5 DAYS		6-10 DAYS		11-15 DAYS		16-20 DAYS		21-25 DAYS		26-30 DAYS		> 30 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE DESIGN	80.68%	0.00%	17.05%	0.00%	0.00%	0.00%	1.14%	0.00%	0.00%	0.00%	1.14%	0.00%	0.00%	0.00%	3.91	0.00
- UNE DESIGN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00
- UNE NON-DESIGN	77.78%	0.00%	0.00%	0.00%	11.11%	0.00%	0.00%	0.00%	11.11%	0.00%	0.00%	0.00%	0.00%	0.00%	4.67	0.00
BST																
LOUISIANA																
- RETAIL DESIGN	28.57%	0.00%	15.87%	0.00%	26.98%	0.00%	6.35%	0.00%	4.76%	0.00%	1.59%	0.00%	15.87%	0.00%	19.14	0.00

Definitions

issue date -- Date service order is entered into the system (not necessarily same as application date)

completion date -- Date on which service order is completed

order completion interval -- computed as order completion interval = completion date - issue date

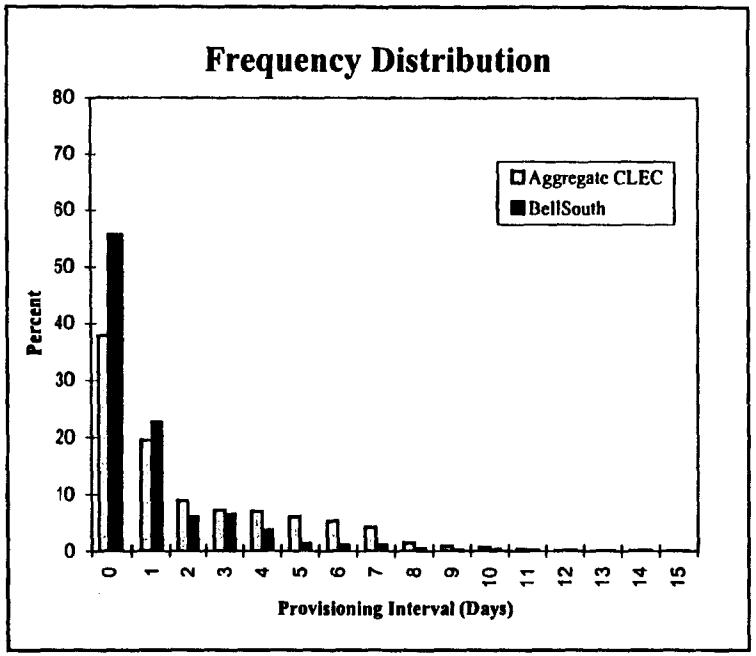
Appendix D
Order Completion Interval (OCI) - September Graphics

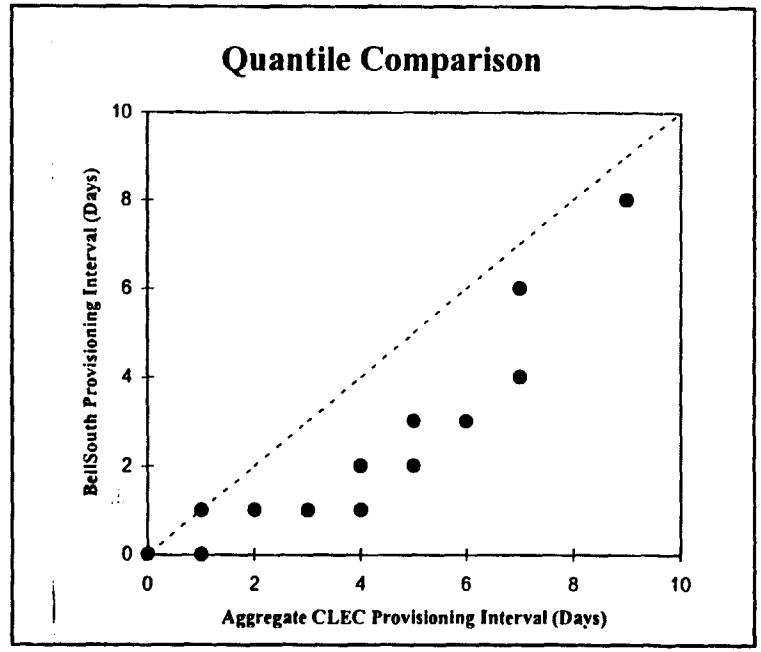
I. Graphical Representations

Unadjusted		Adjusted	
1. All Cases	D-1	1. All Cases	D-2
2. Dispatch Cases	D-3	2. Dispatch Cases	D-4
3. Non-Dispatch Cases	D-5	3. Non-Dispatch Cases	D-6
4. Dispatched, Residential, All Circuits	D-7	4. Dispatched, Residential, All Circuits	D-8
5. Dispatched, Business, All Circuits	D-9	5. Dispatched, Business, All Circuits	D-10
6. Non-Dispatched, Residential, All Circuits	D-11	6. Non-Dispatched, Residential, All Circuits	D-12
7. Non-Dispatched, Business, All Circuits	D-13	7. Non-Dispatched, Business, All Circuits	D-14
8. Dispatched, Residential, Less Than 10 Circuits	D-15	8. Dispatched, Residential, Less Than 10 Circuits	D-16
9. Dispatched, Business, Less Than 10 Circuits	D-17	9. Dispatched, Business, Less Than 10 Circuits	D-18
10. Non-Dispatched, Residential, Less Than 10 Circuits	D-19	10. Non-Dispatched, Residential, Less Than 10 Circuits	D-20
11. Non-Dispatched, Business, Less Than 10 Circuits	D-21	11. Non-Dispatched, Business, Less Than 10 Circuits	D-22

II. SQM D-23

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
All Cases





Descriptive Measures

Service Provider	Mean	Standard Deviation
BellSouth	1.20	2.80
CLEC Aggregate	2.20	2.85
Difference	-1.00	

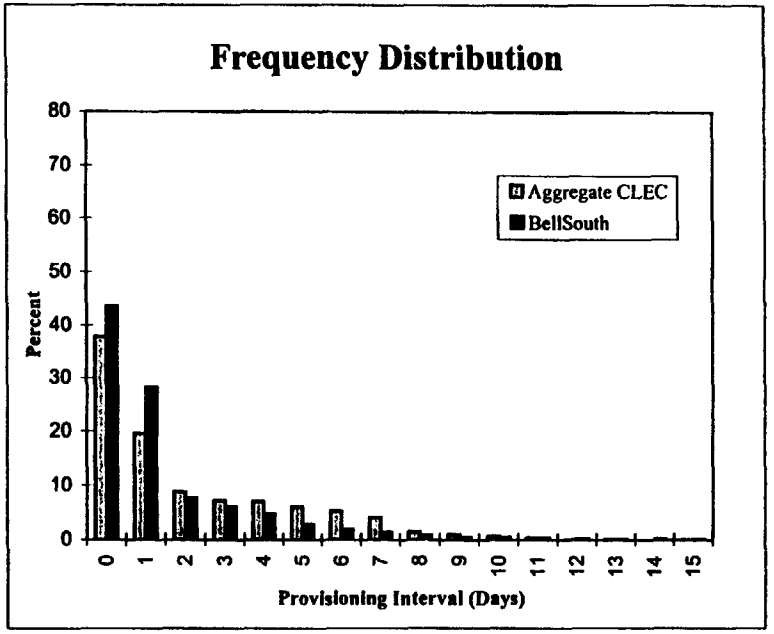
Analytic Measures

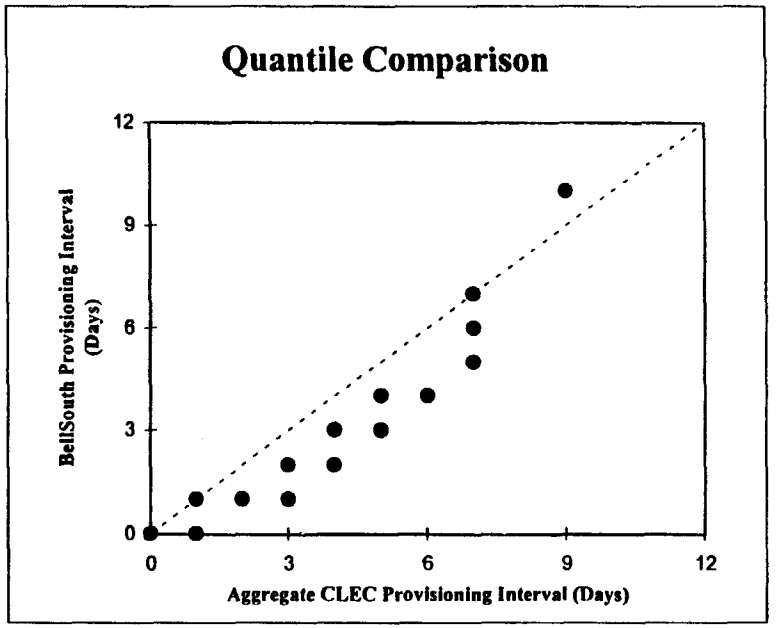
Testing Method	Test Statistic	P-value (percent)
LCUG	-44.78	0.0000
FCC	-44.75	0.0000
BST	-15.14	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.

The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
All Cases





Descriptive Measures

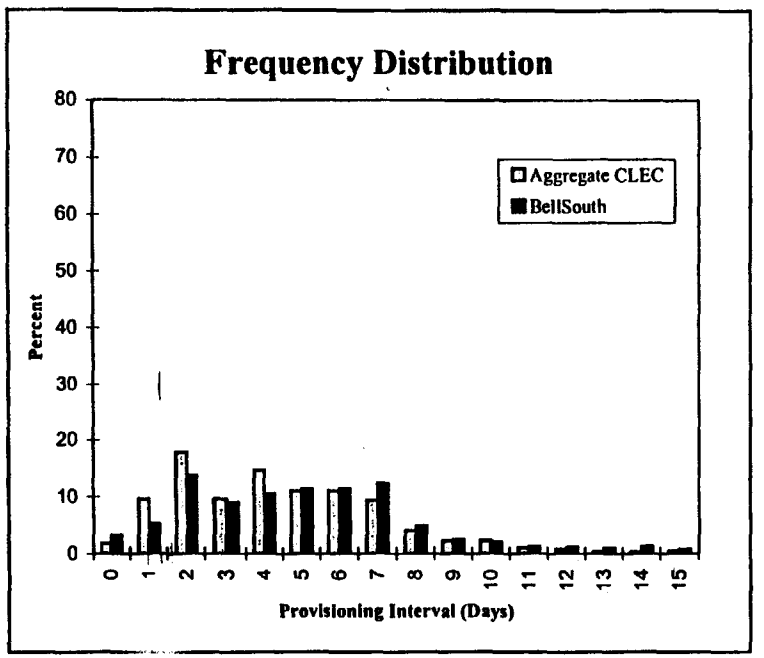
Service Provider	Mean	Standard Deviation
BST	1.61	3.00
CLEC	2.20	2.85
Difference	-0.59	

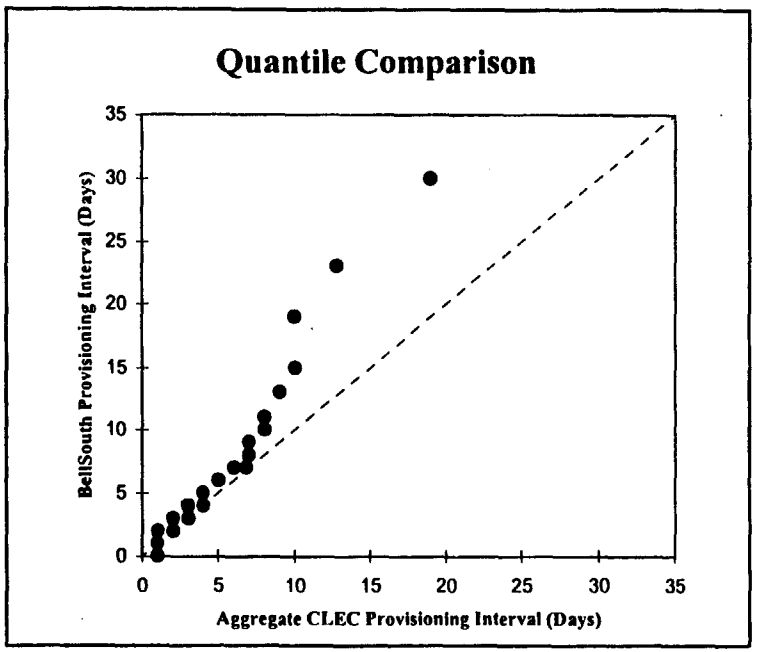
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-24.63	0.0000
FCC	-24.68	0.0000
BST	-8.81	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched Cases





Descriptive Measures

Service Provider	Mean	Standard Deviation
BellSouth	6.76	7.19
CLEC Aggregate	5.07	4.55
Difference	1.69	

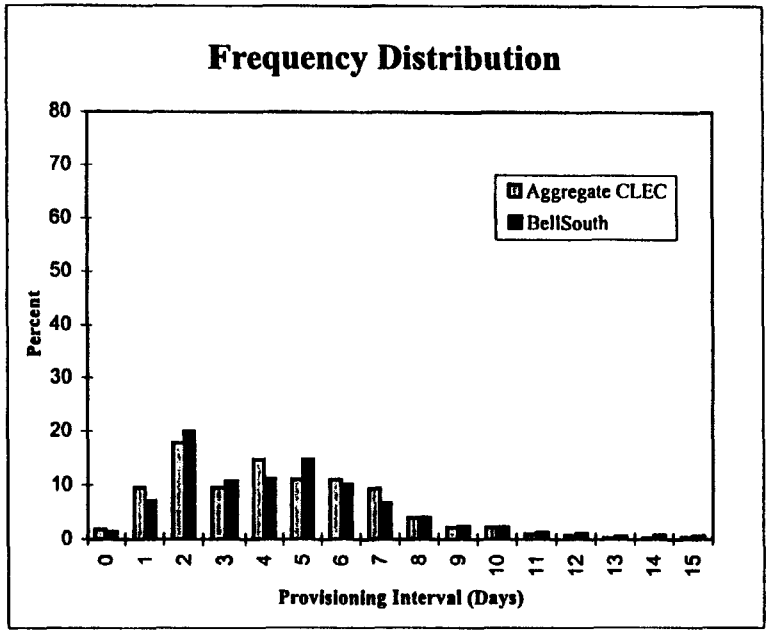
Analytic Measures

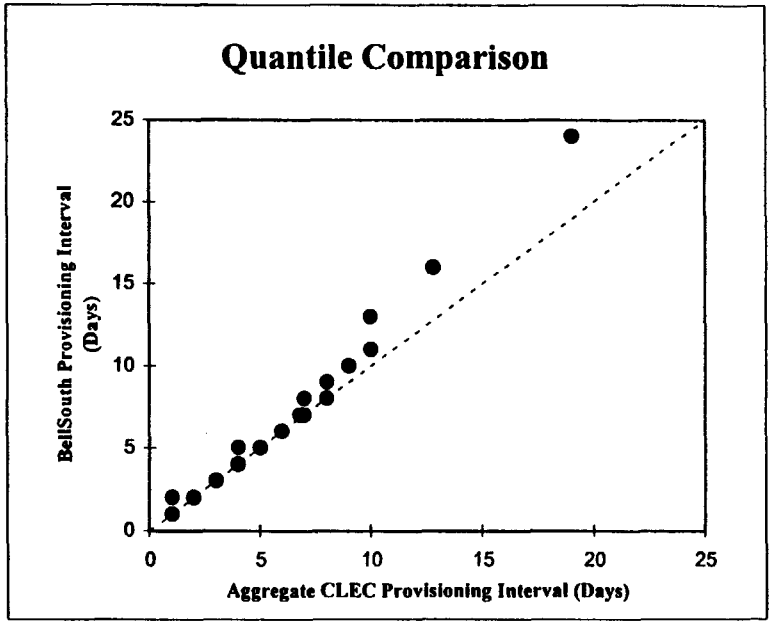
Testing Method	Test Statistic	P-value (percent)
LCUG	8.31	0.0000
FCC	8.46	0.0000
BST	5.85	0.0001

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.

The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched Cases





Descriptive Measures

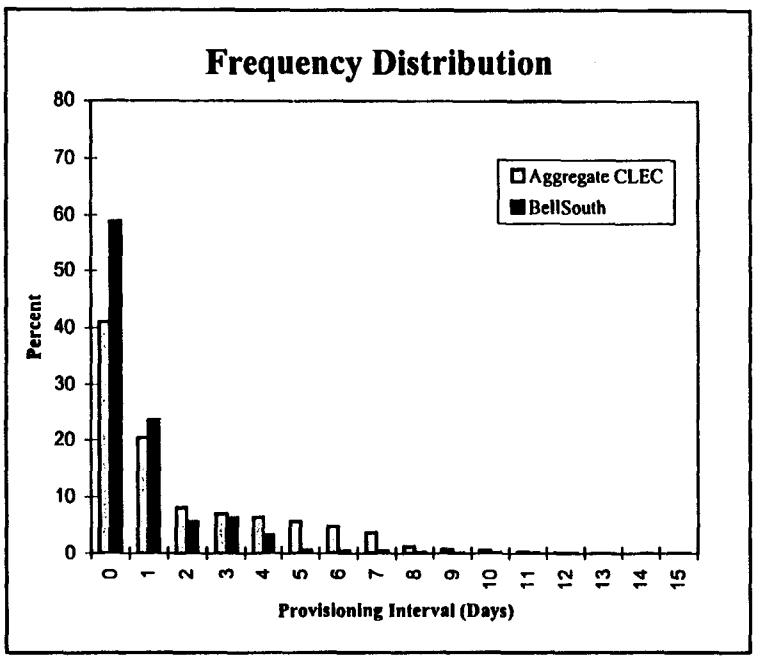
Service Provider	Mean	Standard Deviation
BST	5.52	5.59
CLEC	5.07	4.55
Difference	0.45	

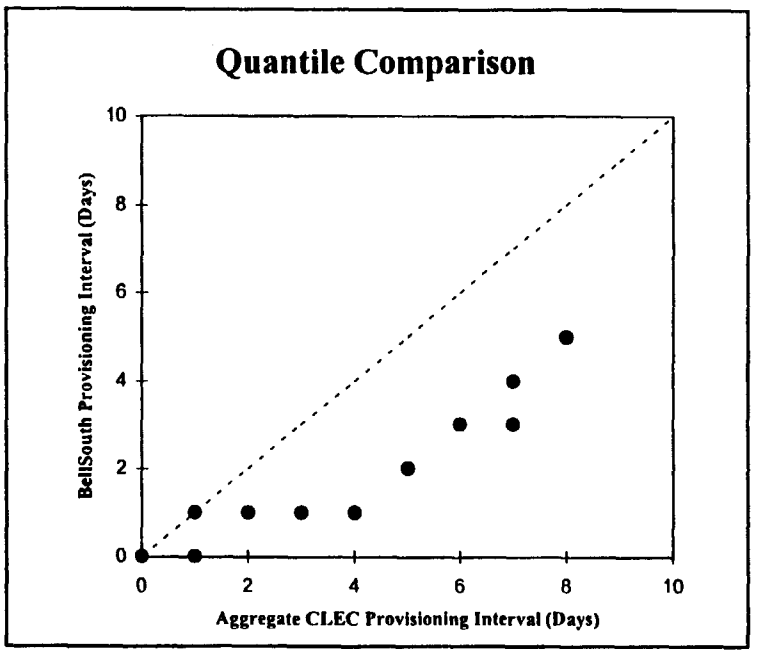
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.87	0.2065
FCC	2.90	0.1884
BST	2.57	0.7876

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched Cases





Descriptive Measures

Service Provider	Mean	Standard Deviation
BellSouth	0.86	1.75
CLEC Aggregate	1.95	2.50
Difference	-1.09	

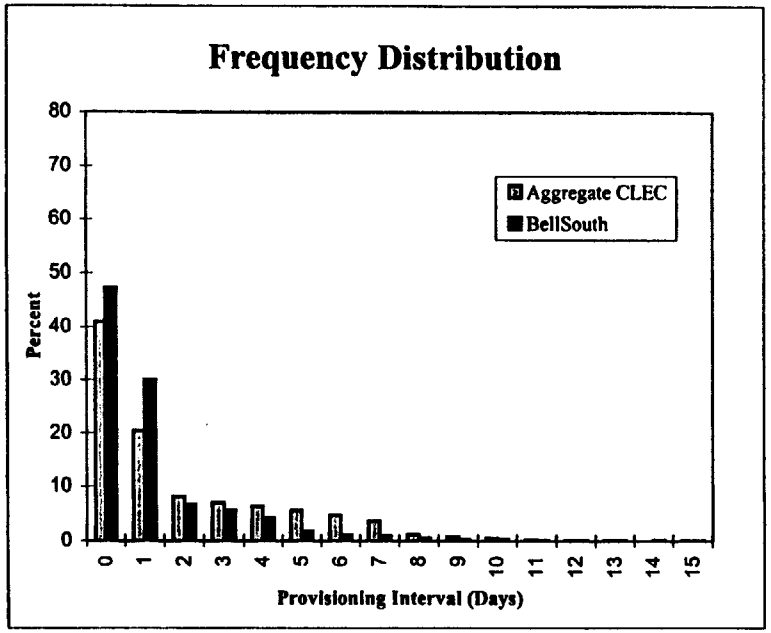
Analytic Measures

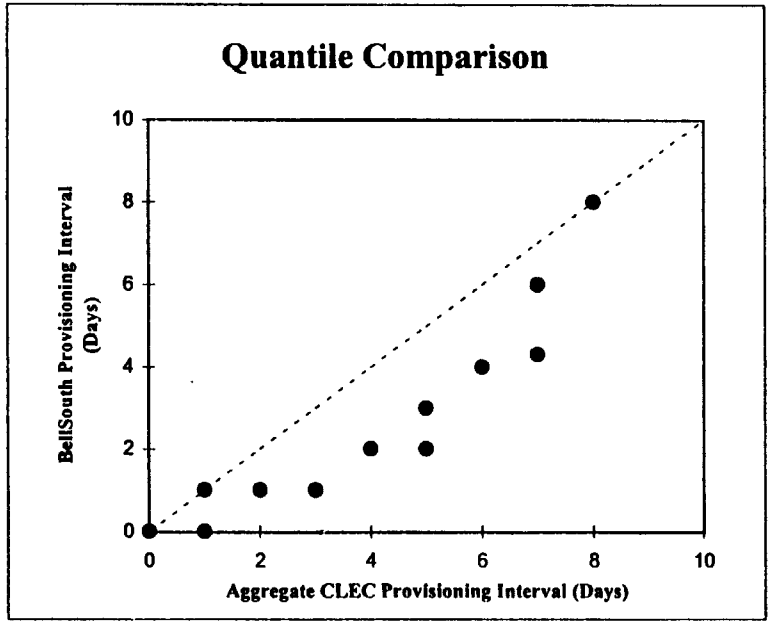
Testing Method	Test Statistic	P-value (percent)
LCUG	-75.05	0.0000
FCC	-73.46	0.0000
BST	-17.15	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.

The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched Cases





Descriptive Measures

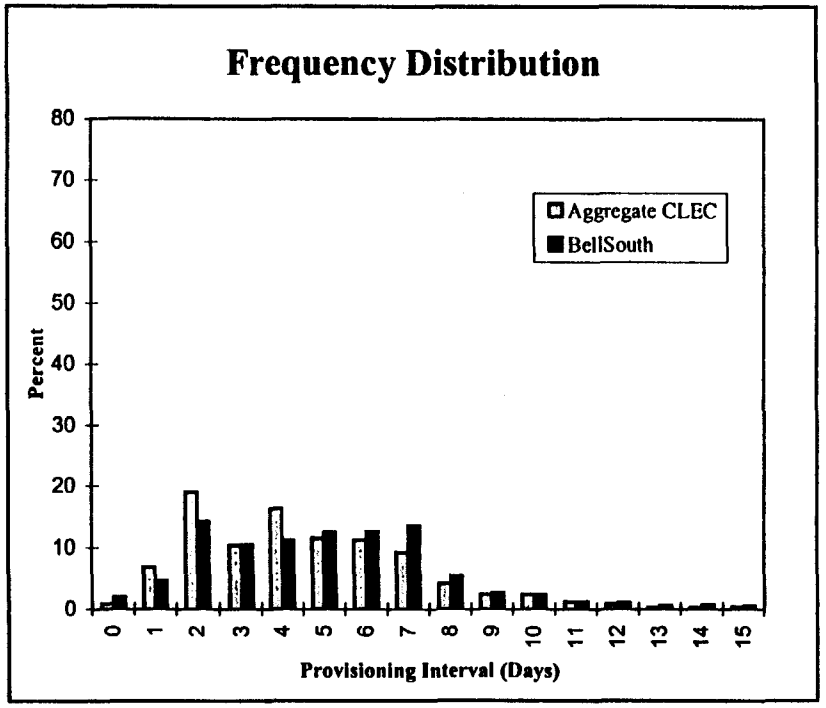
Service Provider	Mean	Standard Deviation
BST	1.27	2.38
CLEC	1.95	2.50
Difference	-0.68	

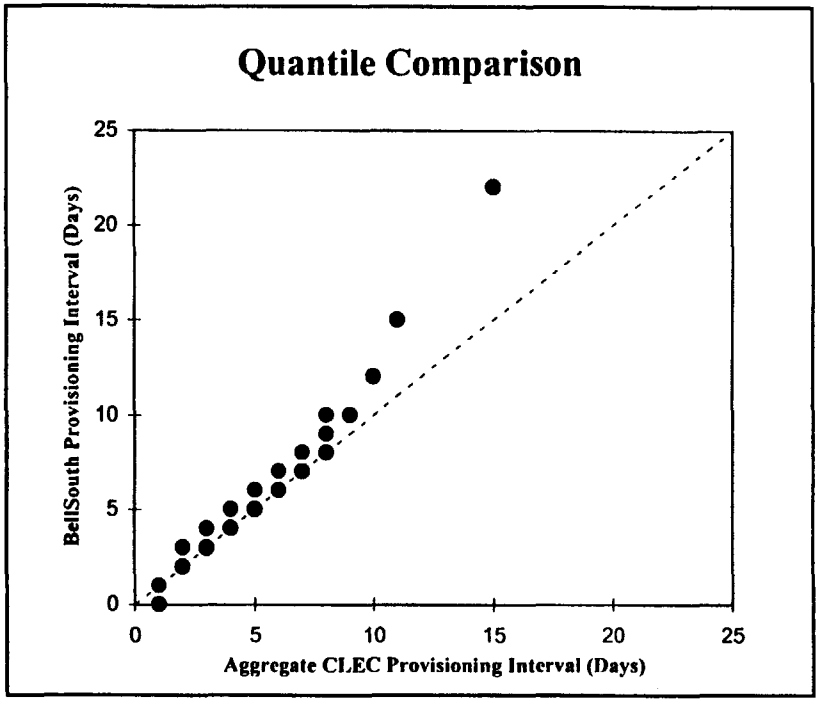
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-34.35	0.0000
FCC	-34.27	0.0000
BST	-9.93	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, All Circuits





Descriptive Measures

Service Provider	Mean	Standard Deviation
BellSouth	5.77	4.78
CLEC Aggregate	4.93	3.59
Difference	0.84	

Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.77	0.0000
FCC	5.86	0.0000
BST	5.41	0.0004

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
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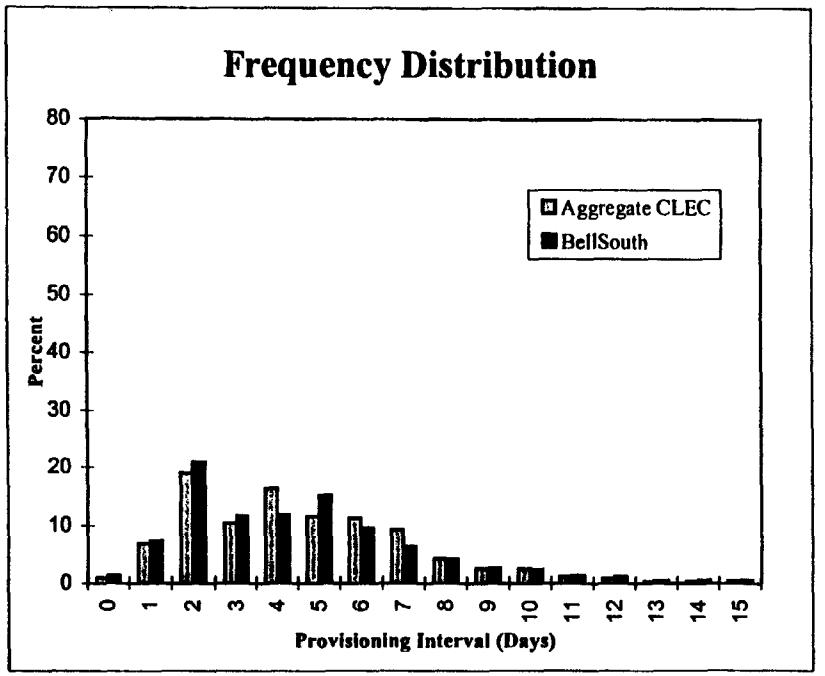
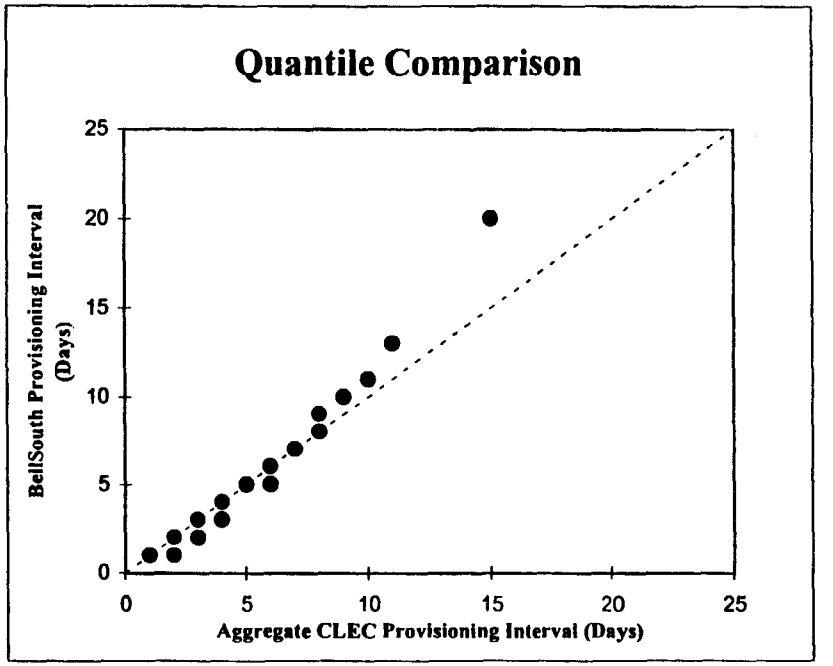
Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, All Circuits





Descriptive Measures

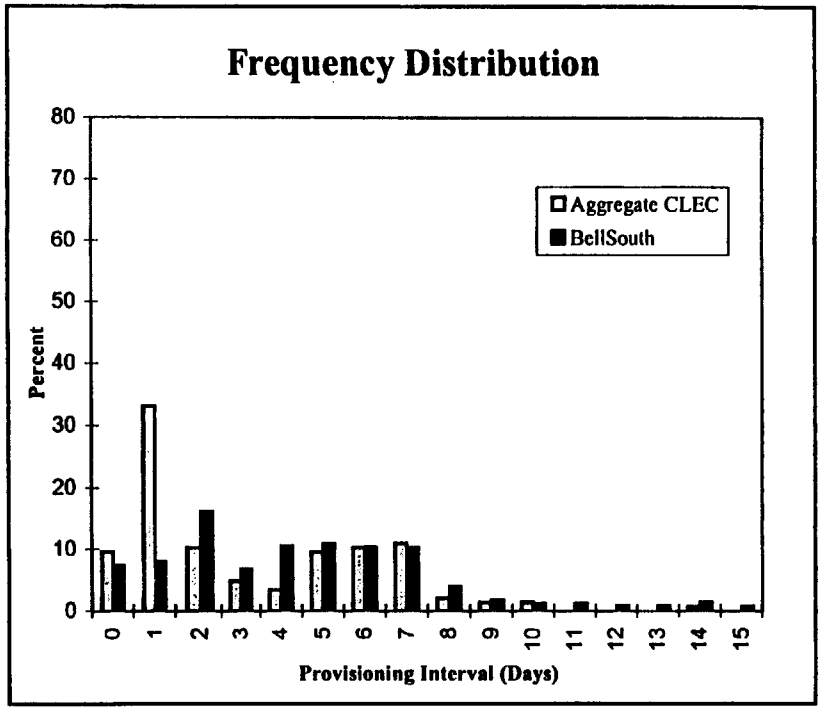
Service Provider	Mean	Standard Deviation
BST	5.05	4.48
CLEC	4.93	3.59
Difference	0.12	

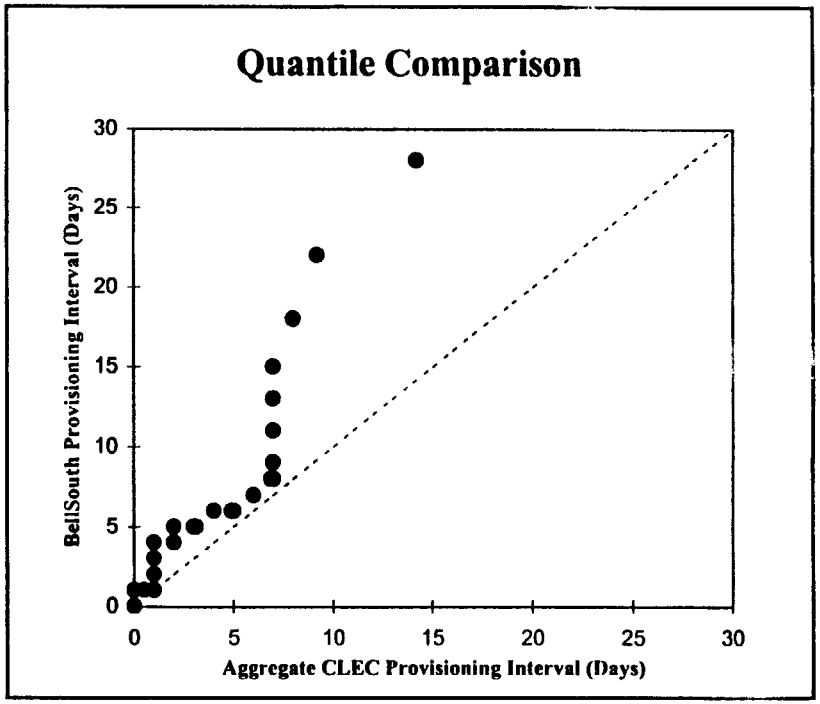
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.89	18.6182
FCC	0.90	18.3006
BST	0.78	22.0733

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, All Circuits





Descriptive Measures

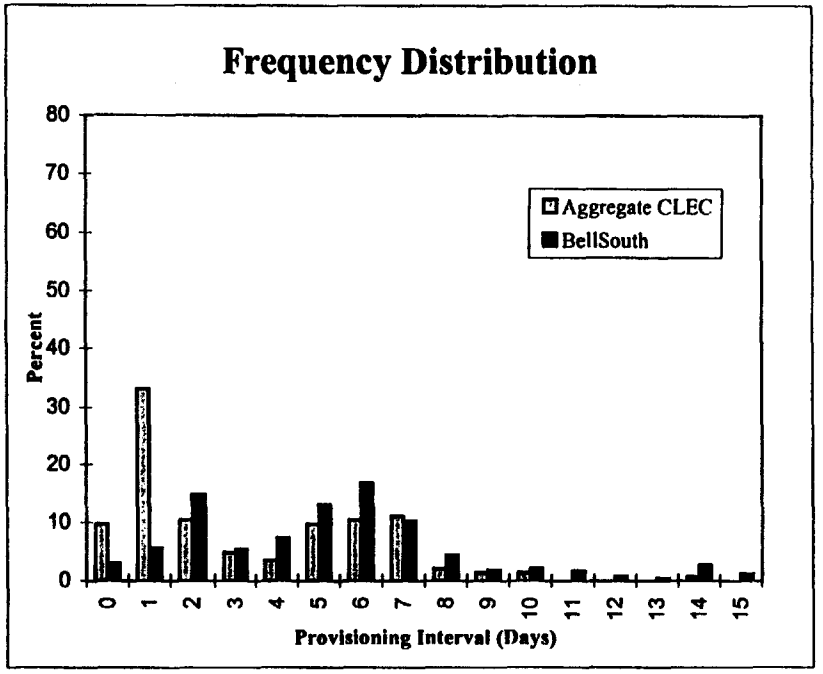
Service Provider	Mean	Standard Deviation
BellSouth	6.11	7.14
CLEC Aggregate	3.75	4.39
Difference	2.36	

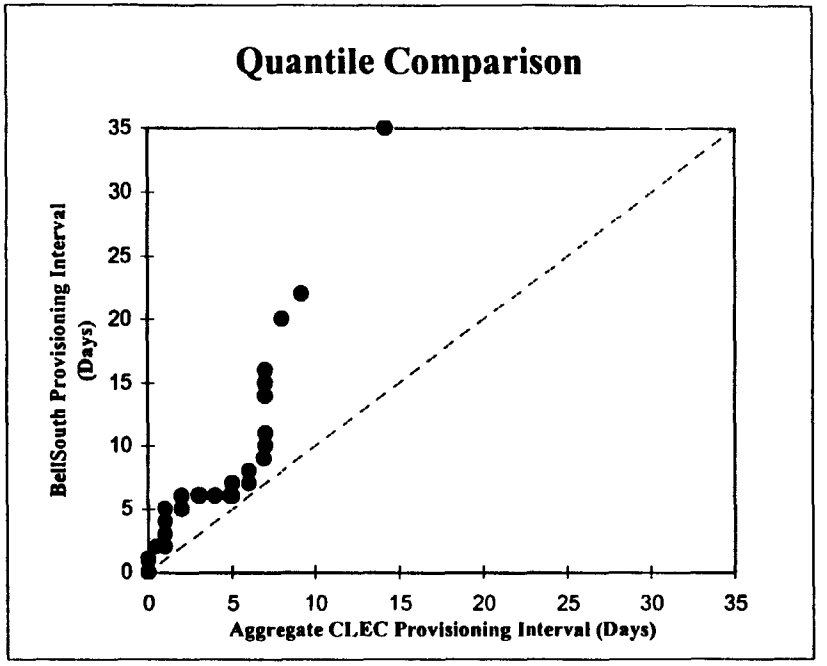
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	3.93	0.0042
FCC	3.97	0.0037
BST	1.55	6.7635

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, All Circuits





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	7.20	8.20
CLEC	3.75	4.39
Difference	3.45	

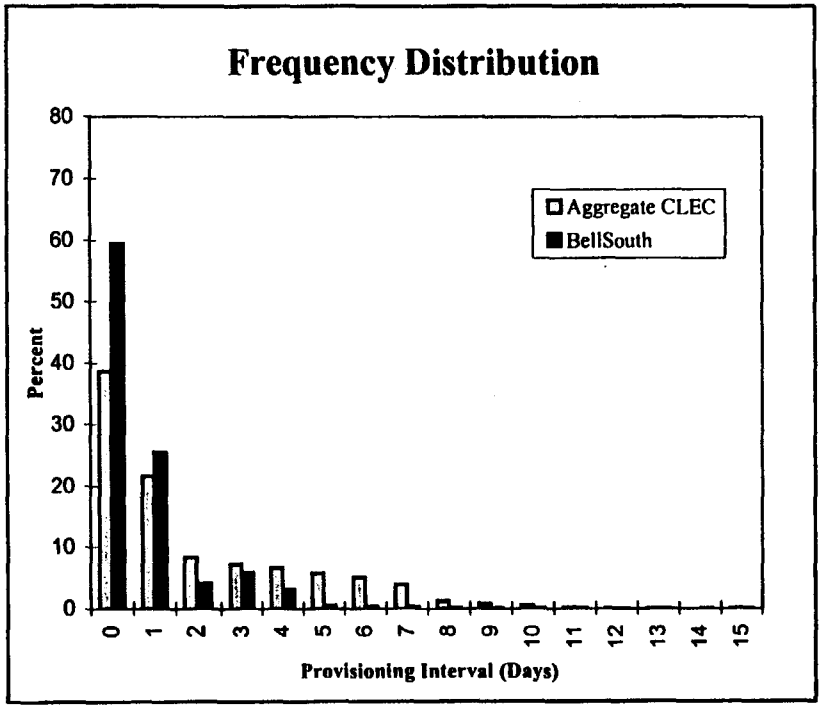
Analytic Measures

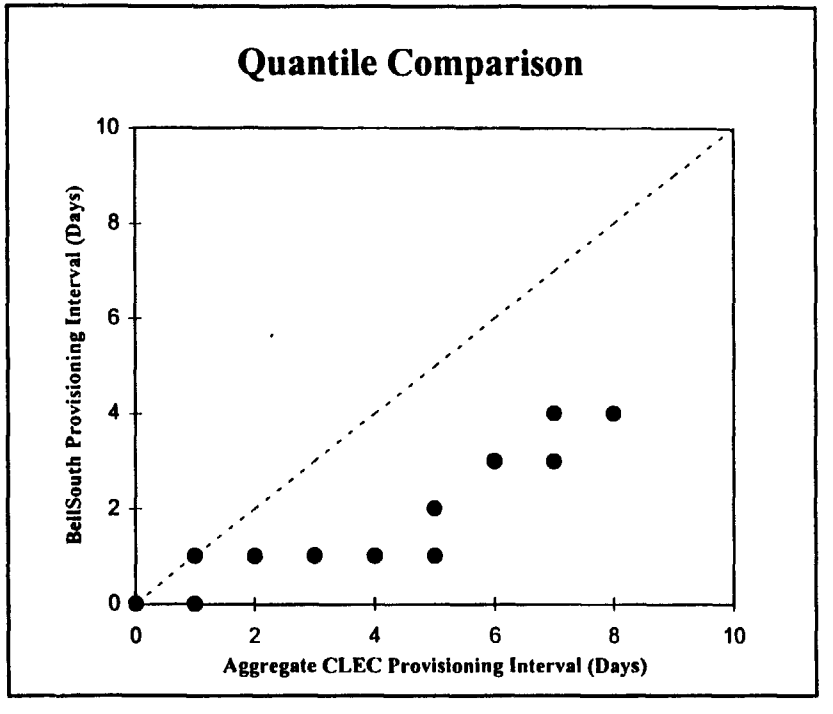
Testing Method	Test Statistic	P-value (percent)
LCUG	5.00	0.0000
FCC	5.05	0.0000
BST	2.17	2.0650

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.

The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, All Circuits





Descriptive Measures

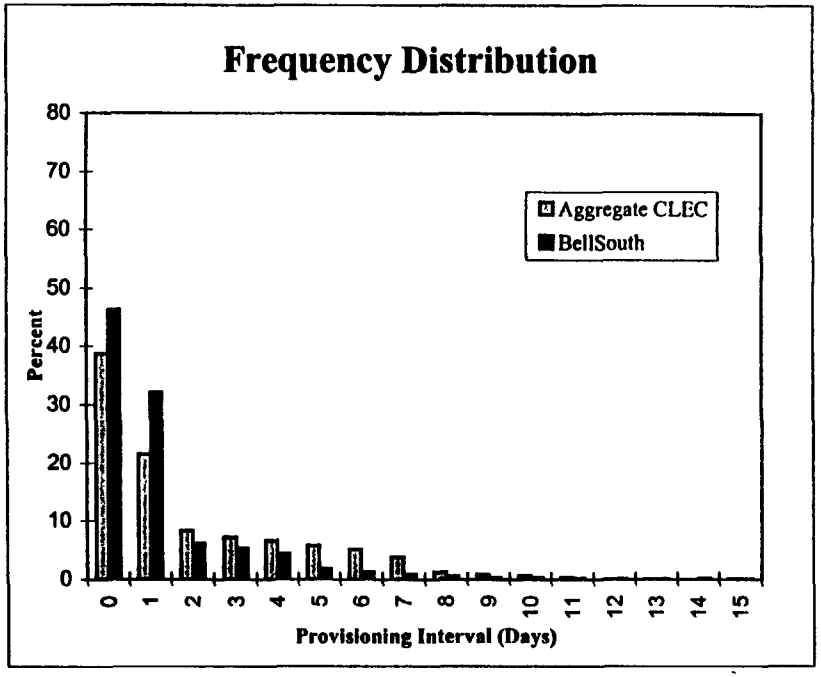
Service Provider	Mean	Standard Deviation
BellSouth	0.80	1.64
CLEC Aggregate	2.01	2.48
Difference	-1.21	

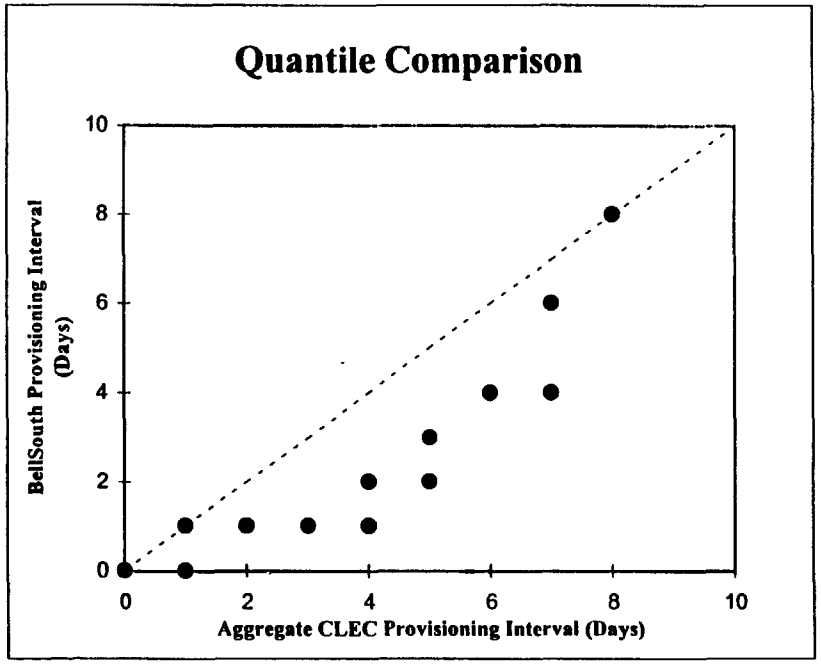
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-84.98	0.0000
FCC	-82.71	0.0000
BST	-18.25	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, All Circuits





Descriptive Measures

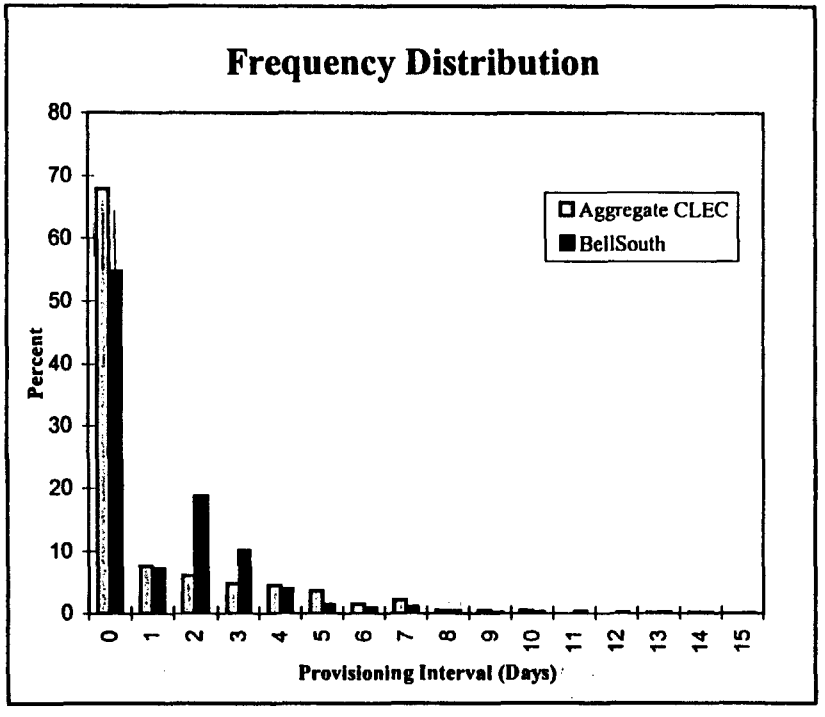
Service Provider	Mean	Standard Deviation
BST	1.26	2.33
CLEC	2.01	2.48
Difference	-0.75	

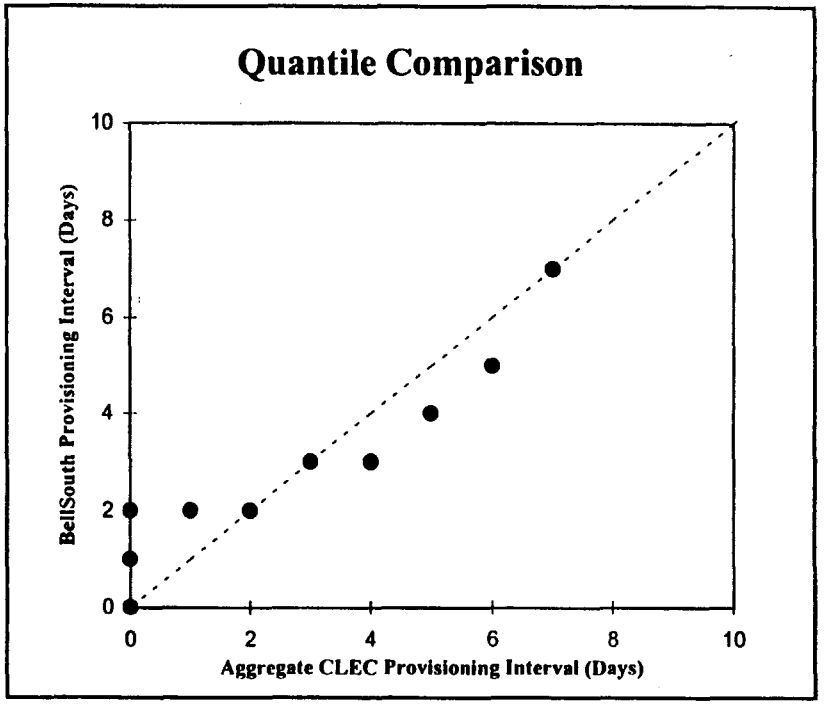
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-37.16	0.0000
FCC	-37.05	0.0000
BST	-11.75	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, All Circuits





Descriptive Measures

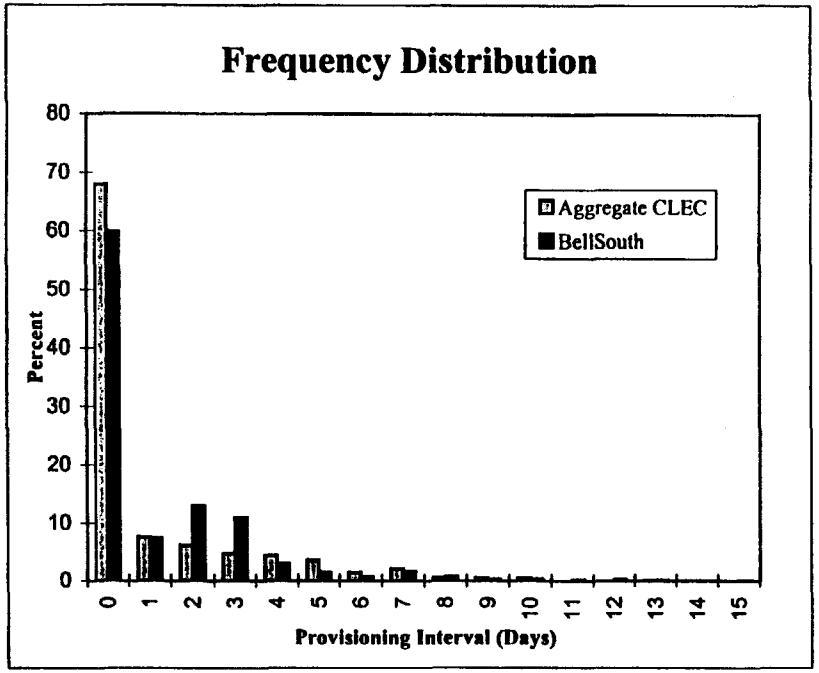
Service Provider	Mean	Standard Deviation
BellSouth	1.33	2.42
CLEC Aggregate	1.13	2.19
Difference	0.20	

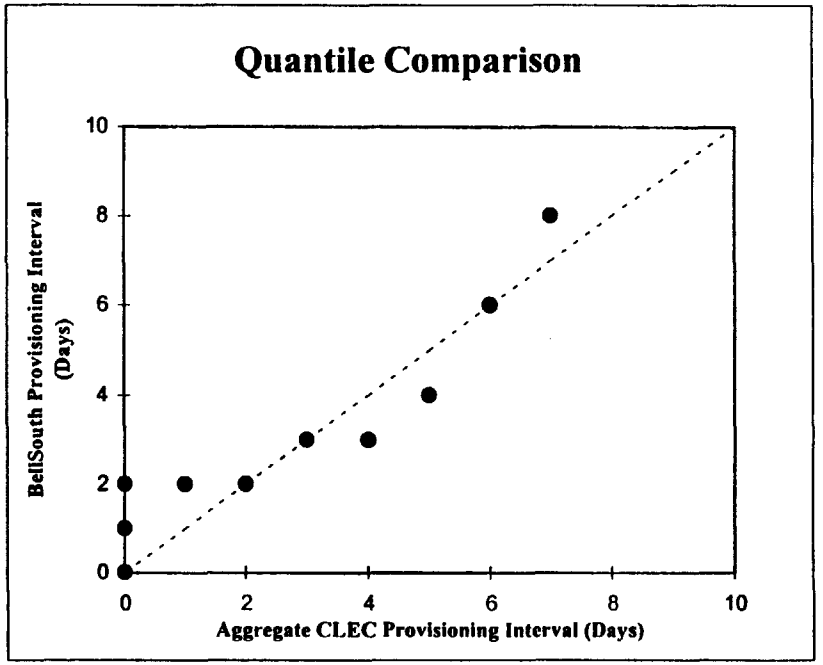
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.88	0.1962
FCC	2.89	0.1907
BST	0.70	24.5277

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, All Circuits





Descriptive Measures

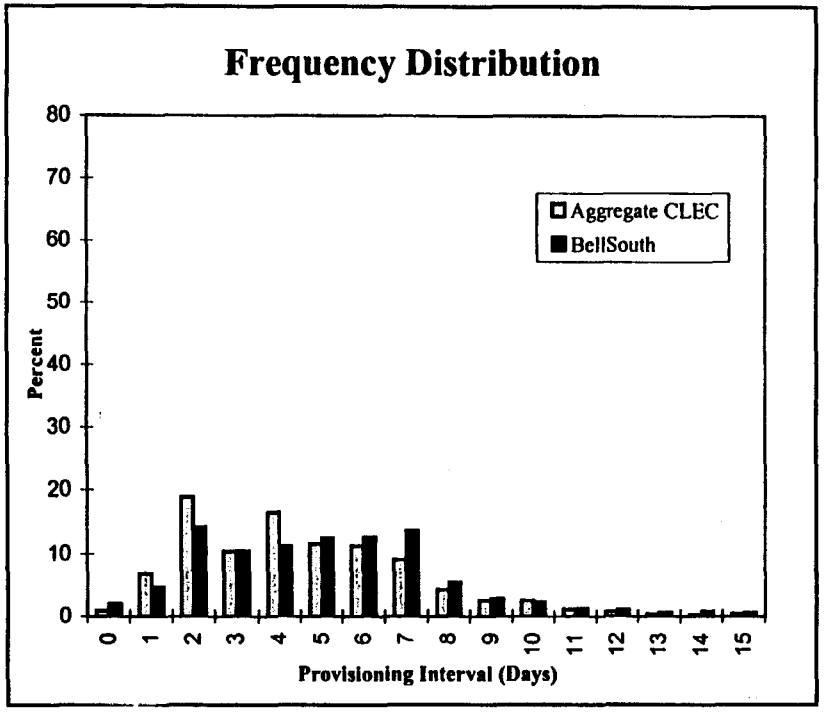
Service Provider	Mean	Standard Deviation
BST	1.27	2.47
CLEC	1.13	2.19
Difference	0.14	

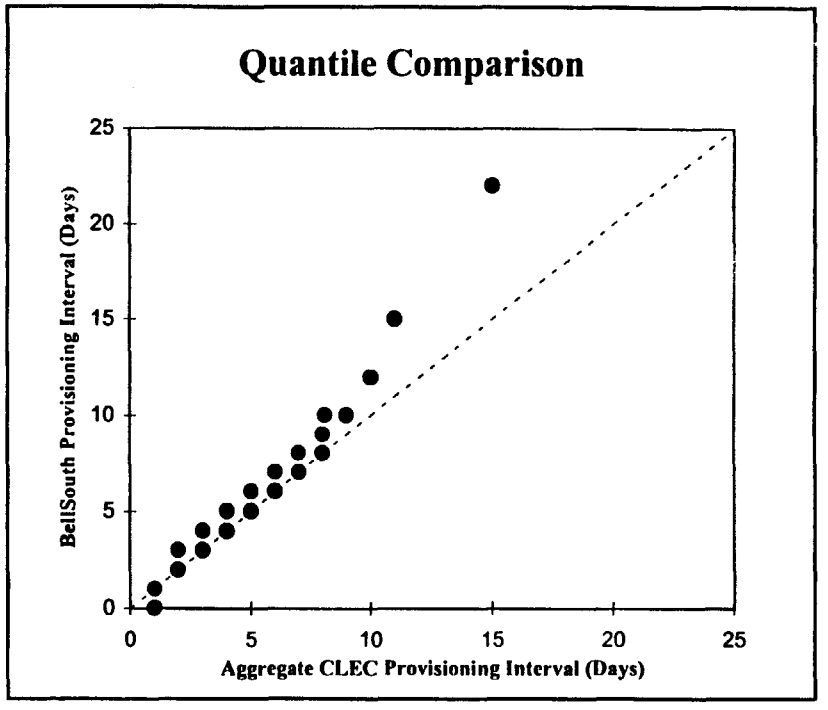
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.01	2.2195
FCC	2.02	2.1814
BST	0.49	31.4900

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

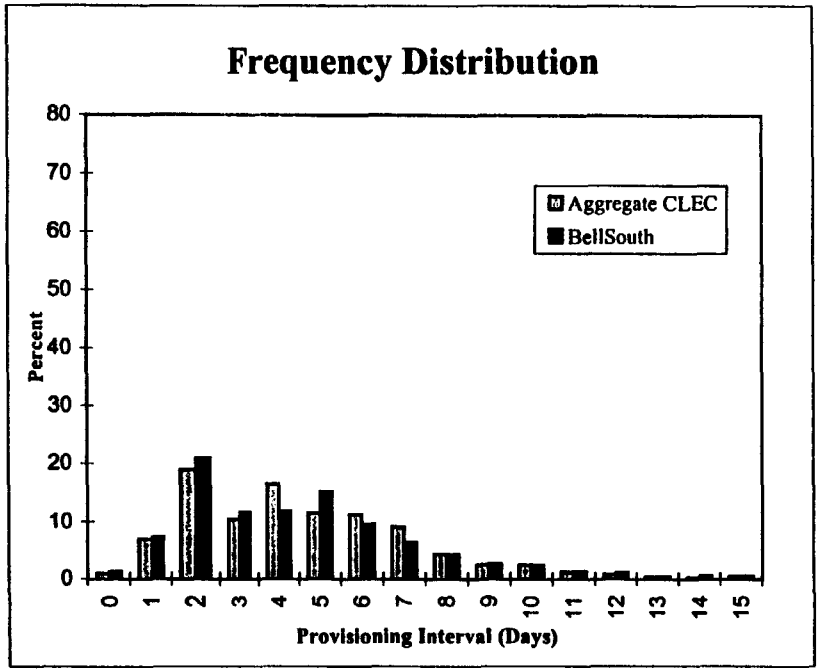
Service Provider	Mean	Standard Deviation
BST	5.76	4.78
CLEC	4.93	3.59
Difference	0.83	

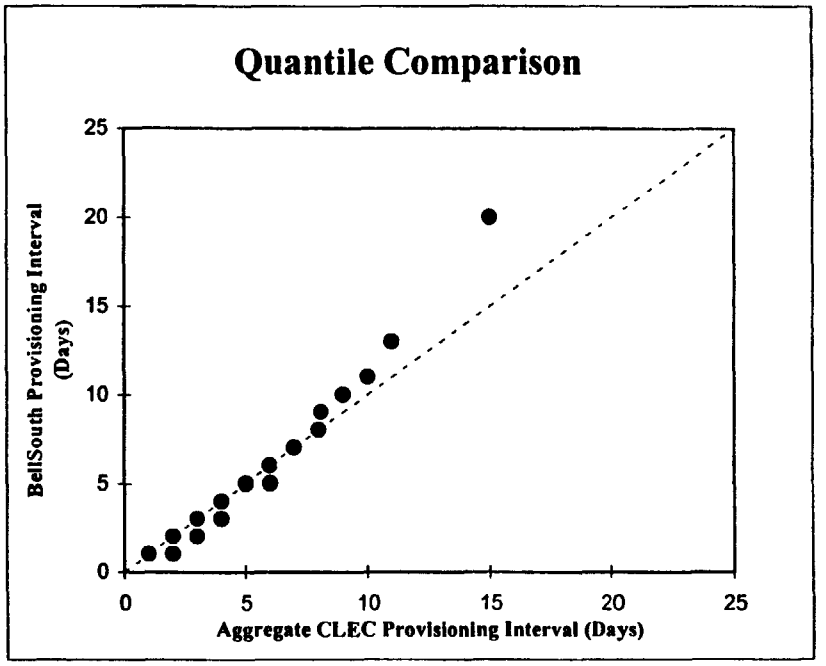
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.69	0.0000
FCC	5.79	0.0000
BST	5.43	0.0004

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

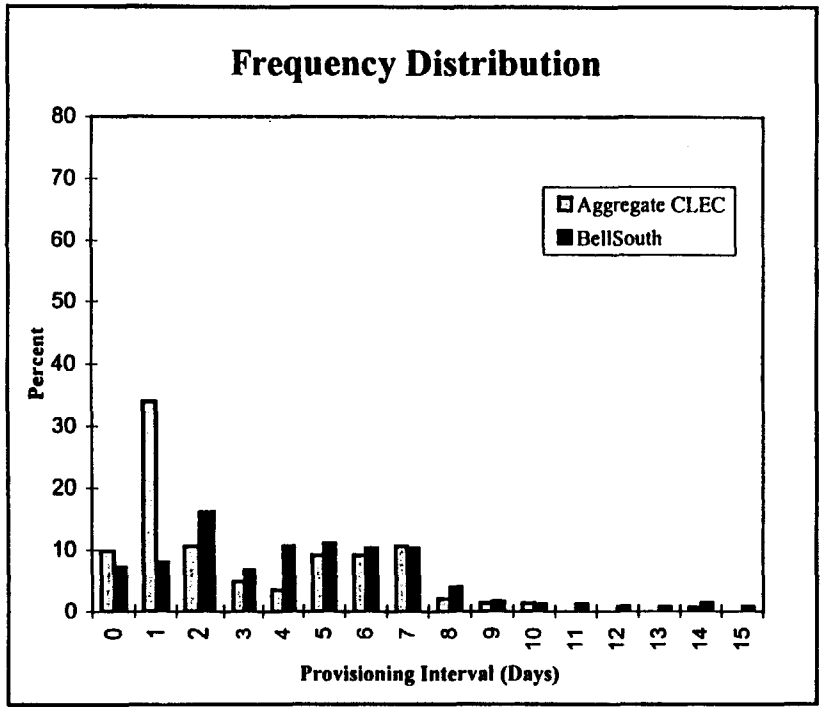
Service Provider	Mean	Standard Deviation
BST	5.05	4.48
CLEC	4.93	3.59
Difference	0.12	

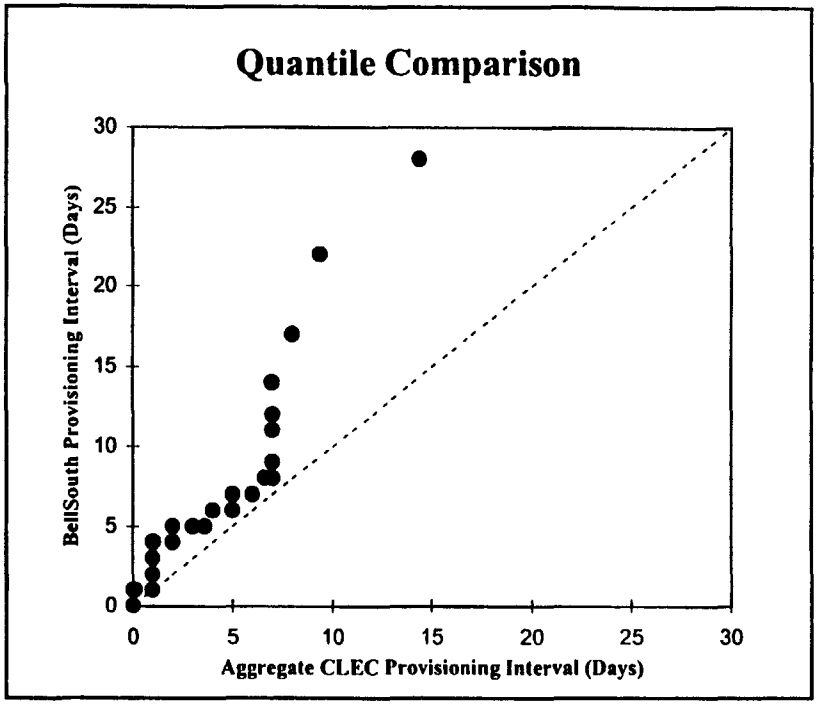
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.90	18.4376
FCC	0.91	18.1197
BST	0.78	22.0708

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

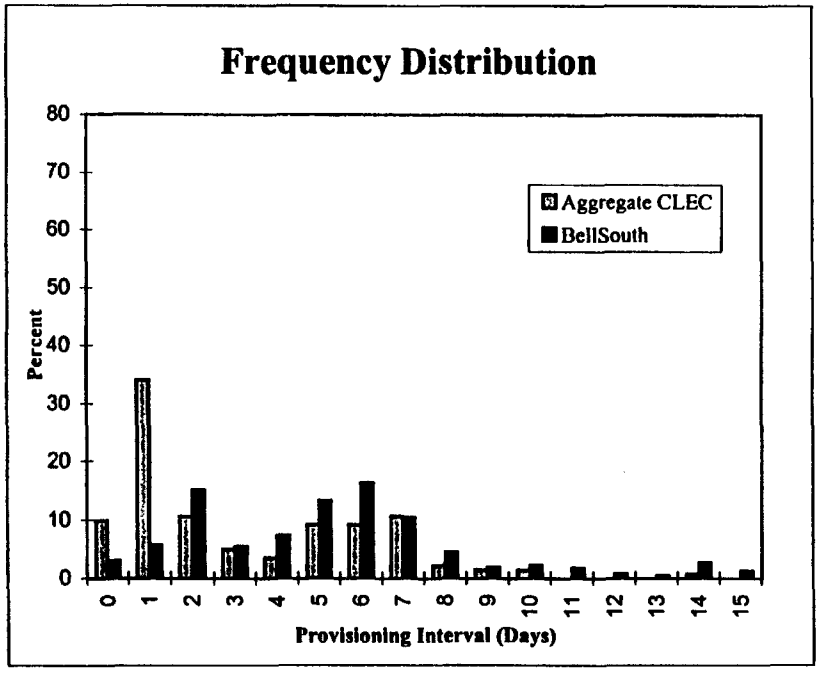
Service Provider	Mean	Standard Deviation
BellSouth	6.01	6.83
CLEC Aggregate	3.69	4.43
Difference	2.32	

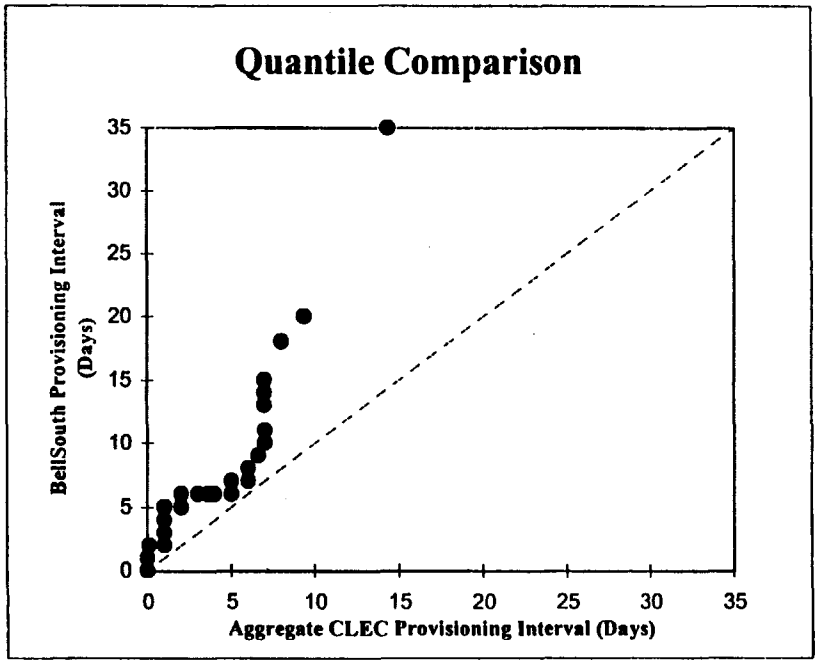
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	3.98	0.0035
FCC	4.01	0.0031
BST	1.51	7.2860

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

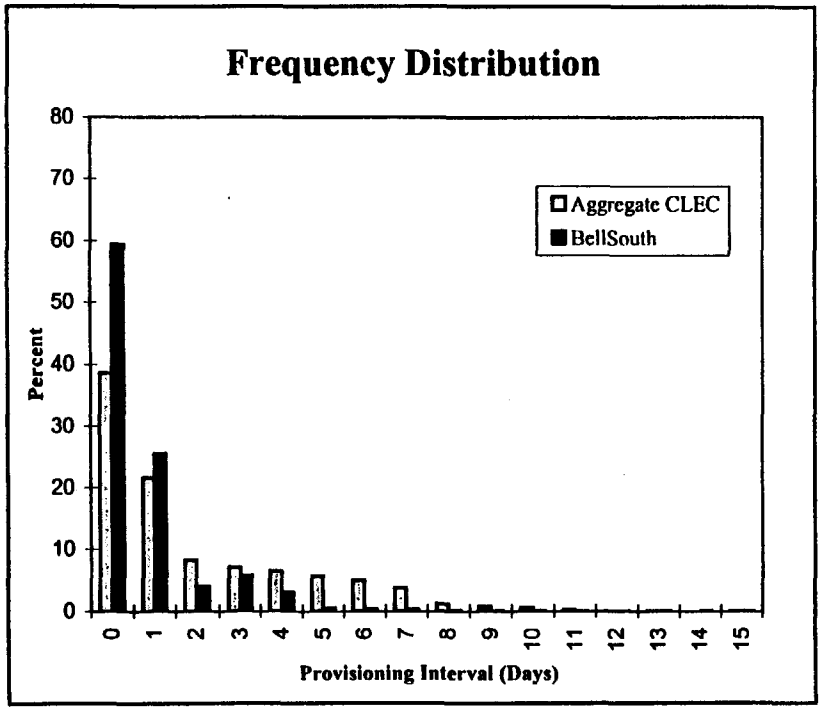
Service Provider	Mean	Standard Deviation
BST	6.96	8.01
CLEC	3.69	4.43
Difference	3.27	

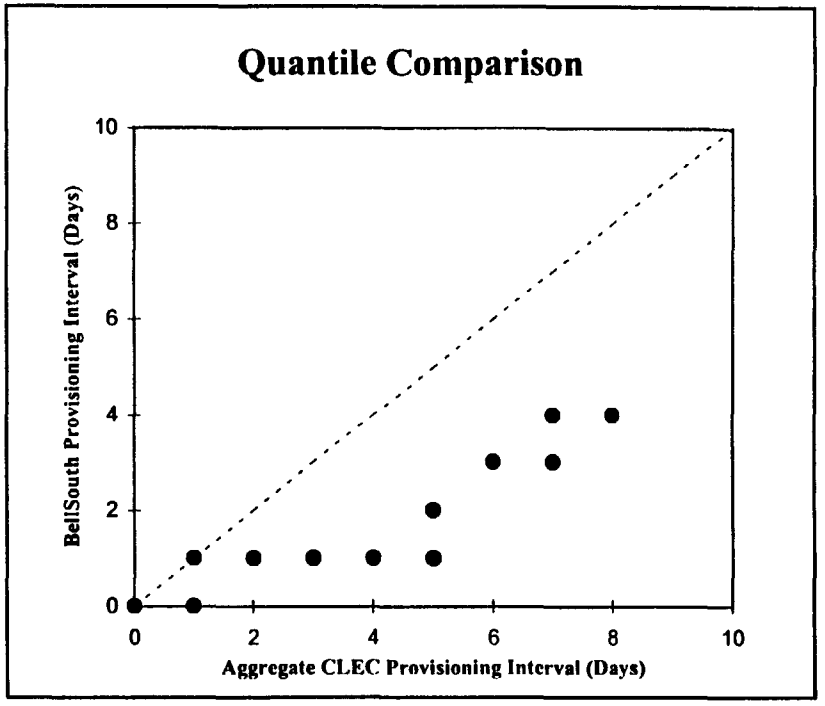
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	4.78	0.0001
FCC	4.83	0.0001
BST	2.07	2.5419

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

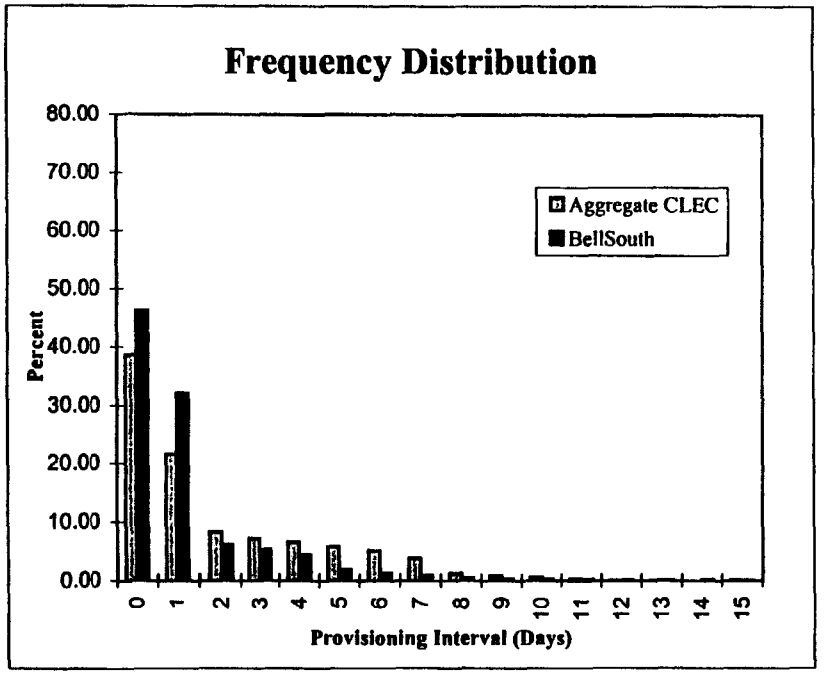
Service Provider	Mean	Standard Deviation
BellSouth	0.80	1.64
CLEC Aggregate	2.01	2.48
Difference	-1.21	

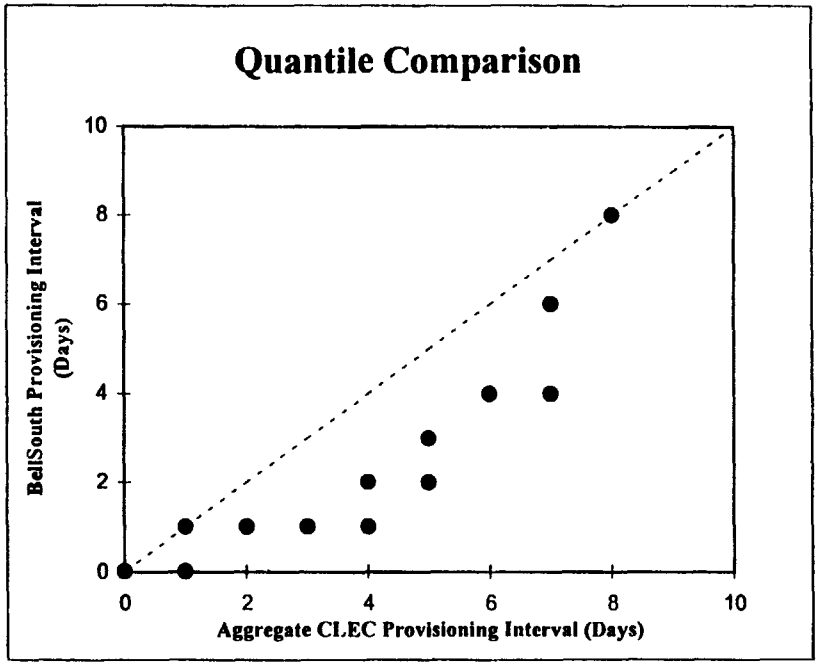
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-84.97	0.0000
FCC	-82.70	0.0000
BST	-18.25	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Residential, Less Than 10 Circuits





Descriptive Measures

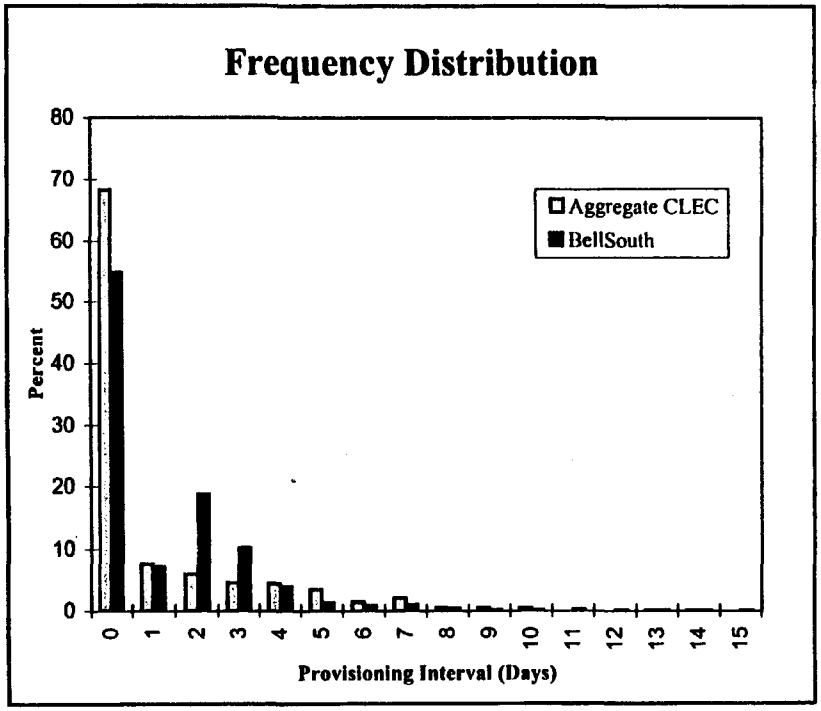
Service Provider	Mean	Standard Deviation
BST	1.26	2.33
CLEC	2.01	2.48
Difference	-0.75	

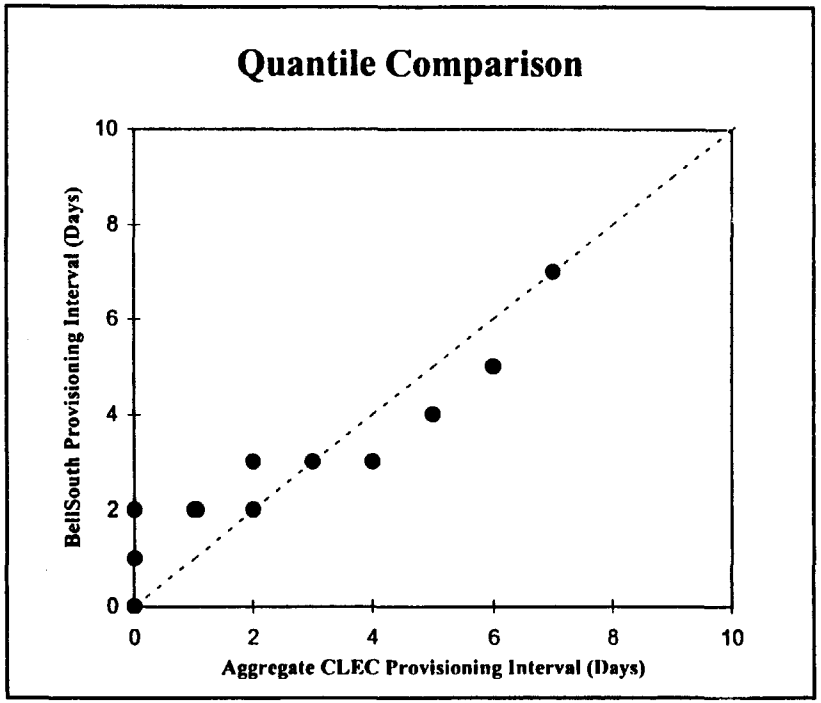
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-37.15	0.0000
FCC	-37.04	0.0000
BST	-11.75	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

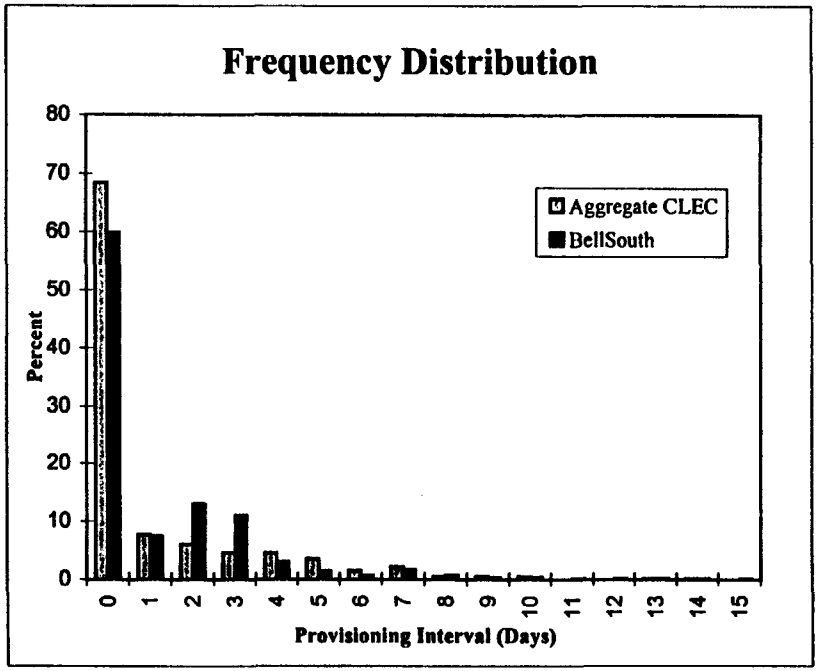
Service Provider	Mean	Standard Deviation
BellSouth	1.33	2.42
CLEC Aggregate	1.12	2.19
Difference	0.21	

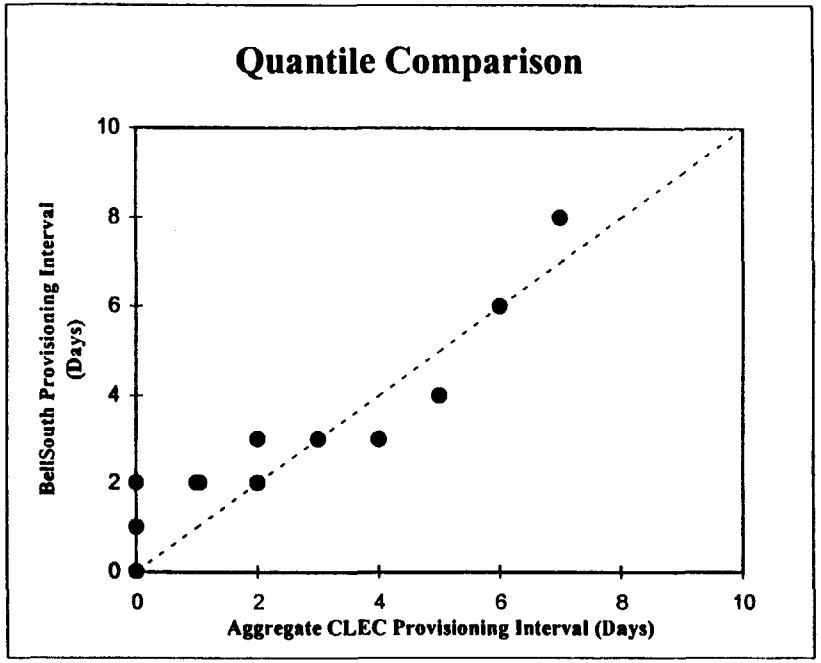
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	3.00	0.1353
FCC	3.01	0.1313
BST	0.72	23.7394

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Non-Dispatched, Business, Less Than 10 Circuits





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	1.27	2.47
CLEC	1.12	2.19
Difference	0.15	

Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.15	1.5811
FCC	2.16	1.5505
BST	0.52	30.3765

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

SQM: Order Completion Interval

SEPTEMBER

	DISPATCH															
	SAME DAY		1 DAY		2 DAYS		3 DAYS		4 DAYS		5 DAYS		> 5 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE RESIDENCE	0.96%	0.00%	6.75%	0.00%	18.33%	50.00%	10.37%	0.00%	15.92%	0.00%	11.33%	0.00%	36.33%	50.00%	5.18	4.50
- RESALE BUSINESS	9.70%	0.00%	29.09%	0.00%	10.91%	0.00%	6.06%	0.00%	5.45%	0.00%	9.70%	40.00%	29.09%	60.00%	3.99	5.80
- UNE LOOPS WITH LNP																
BST																
LOUISIANA																
- RETAIL RESIDENCE	2.46%	2.15%	4.73%	4.30%	12.95%	10.75%	9.98%	16.13%	10.48%	6.45%	11.61%	16.13%	47.79%	44.09%	6.46	6.66
- RETAIL BUSINESS	6.71%	6.12%	7.49%	4.76%	14.41%	8.16%	6.44%	4.76%	9.96%	3.40%	9.99%	4.08%	45.00%	68.71%	8.07	14.63

	DISPATCH															
	0-5 DAYS		6-10 DAYS		11-15 DAYS		16-20 DAYS		21-25 DAYS		26-30 DAYS		> 30 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE DESIGN	3.28%	0.00%	29.51%	0.00%	13.11%	0.00%	13.11%	0.00%	16.39%	0.00%	6.56%	0.00%	18.03%	0.00%	19.07	0.00
- UNE DESIGN	6.25%	0.00%	50.00%	0.00%	29.69%	0.00%	7.81%	0.00%	3.13%	0.00%	1.56%	0.00%	1.56%	0.00%	10.97	0.00
- UNE NON-DESIGN	28.13%	0.00%	45.31%	0.00%	18.75%	0.00%	3.13%	0.00%	1.56%	0.00%	3.13%	0.00%	0.00%	0.00%	8.73	0.00
BST																
LOUISIANA																
- RETAIL DESIGN	10.33%	66.67%	15.38%	11.11%	16.18%	0.00%	10.46%	0.00%	14.55%	11.11%	8.92%	0.00%	24.18%	11.11%	23.67	10.11

Definitions

Issue date -- Date service order is entered into the system (not necessarily same as application date)

completion date -- Date on which service order is completed

order completion interval -- computed as order completion interval = completion date - issue date

SQM: Order Completion Interval

SEPTEMBER

	NO DISPATCH															
	SAME DAY		1 DAY		2 DAYS		3 DAYS		4 DAYS		5 DAYS		> 5 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE RESIDENCE	38.45%	0.00%	21.68%	0.00%	8.47%	0.00%	7.24%	0.00%	6.54%	0.00%	5.73%	100.00%	11.90%	0.00%	2.01	5.00
- RESALE BUSINESS	64.94%	0.00%	8.38%	0.00%	7.93%	42.86%	4.95%	42.86%	4.57%	0.00%	3.66%	14.29%	5.56%	0.00%	1.20	2.86
- UNE LOOPS WITH LNP																
BST																
LOUISIANA																
- RETAIL RESIDENCE	59.13%	0.00%	25.51%	0.00%	4.14%	0.00%	5.89%	0.00%	3.21%	0.00%	0.59%	0.00%	1.53%	0.00%	0.83	0.00
- RETAIL BUSINESS	54.86%	53.54%	7.39%	16.54%	18.50%	10.24%	10.10%	0.79%	3.96%	3.94%	1.37%	4.72%	3.82%	10.24%	1.39	1.77

	NO DISPATCH															
	0-5 DAYS		6-10 DAYS		11-15 DAYS		16-20 DAYS		21-25 DAYS		26-30 DAYS		> 30 DAYS		AVG. (DAYS)	
	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts	< 10 Ckts	>= 10 Ckts
CLEC 1																
LOUISIANA																
CLEC AGGREGATE																
LOUISIANA																
- RESALE DESIGN	76.92%	0.00%	7.69%	0.00%	9.62%	0.00%	0.00%	0.00%	3.85%	0.00%	1.92%	0.00%	0.00%	0.00%	5.83	0.00
- UNE DESIGN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00
- UNE NON-DESIGN	93.94%	0.00%	3.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.03%	0.00%	1.97	0.00
BST																
LOUISIANA																
- RETAIL DESIGN	25.49%	0.00%	23.53%	0.00%	28.76%	0.00%	0.65%	0.00%	4.58%	0.00%	3.92%	0.00%	13.07%	0.00%	14.46	0.00

Definitions

issue date -- Date service order is entered into the system (not necessarily same as application date)

completion date -- Date on which service order is completed

order completion interval -- computed as order completion interval = completion date - issue date

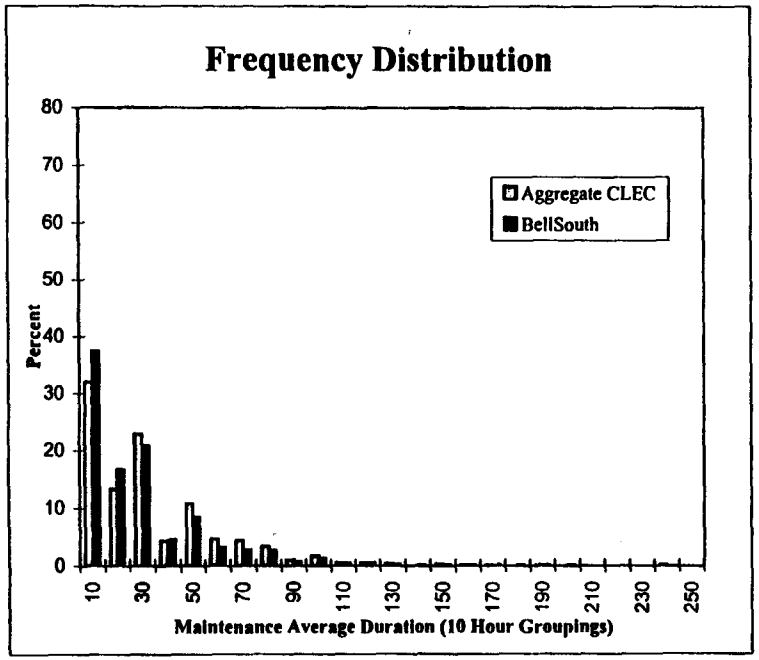
Appendix E
Maintenance Average Duration (MAD) - August Graphics

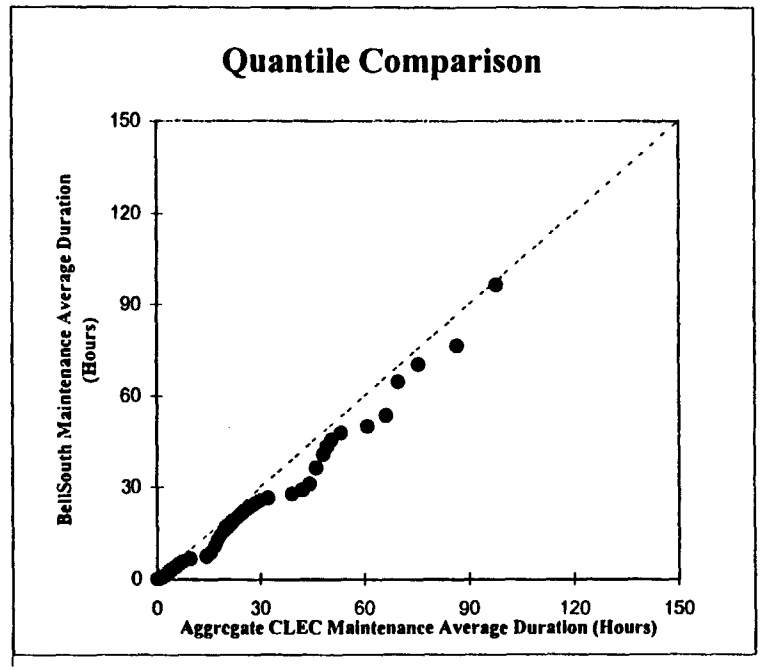
I. Graphical Representations

Unadjusted		Adjusted	
1. All Cases	E-1	1. All Cases	E-2
2. Dispatched	E-3	2. Dispatched	E-4
3. Non-Dispatched	E-5	3. Non-Dispatched	E-6
4. Dispatched, Residential	E-7	4. Dispatched, Residential	E-8
5. Dispatched, Business	E-9	5. Dispatched, Business	E-10
6. Non-Dispatched, Residential	E-11	6. Non-Dispatched, Residential	E-12
7. Non-Dispatched, Business	E-13	7. Non-Dispatched, Business	E-14

II. SQM E-15

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, All Cases





Descriptive Measures

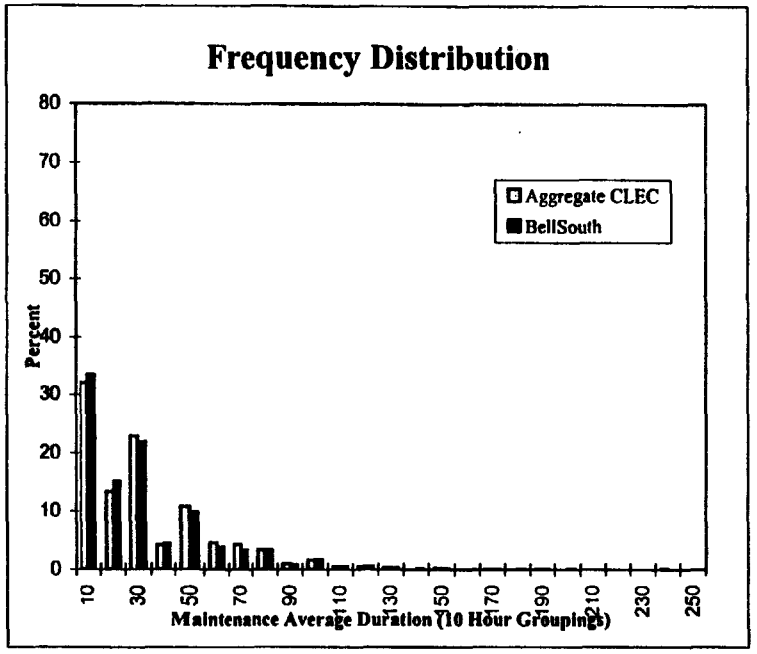
Service Provider	Mean	Standard Deviation
BST	23.45	25.18
CLEC	27.89	27.48
Difference	-4.44	

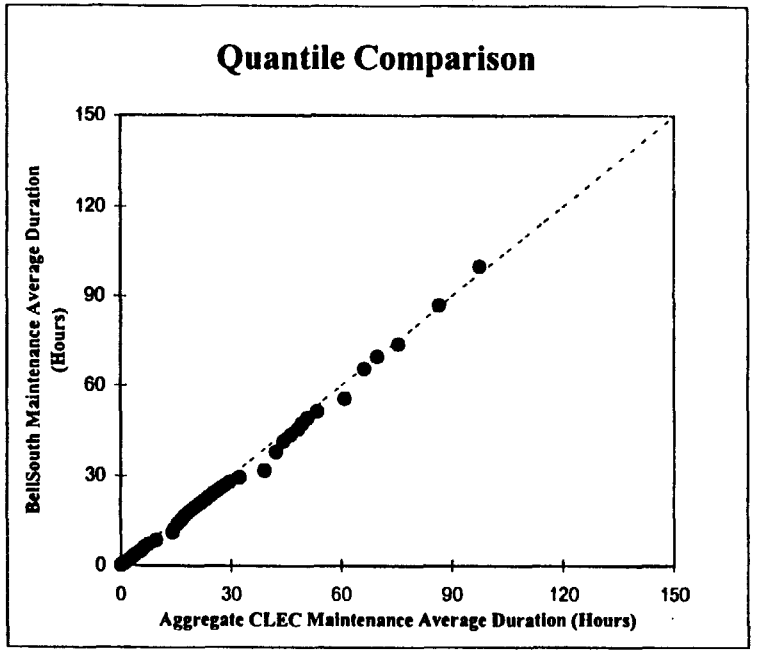
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-6.62	0.0000
FCC	-6.61	0.0000
BST	-4.30	0.0089

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, All Cases





Descriptive Measures

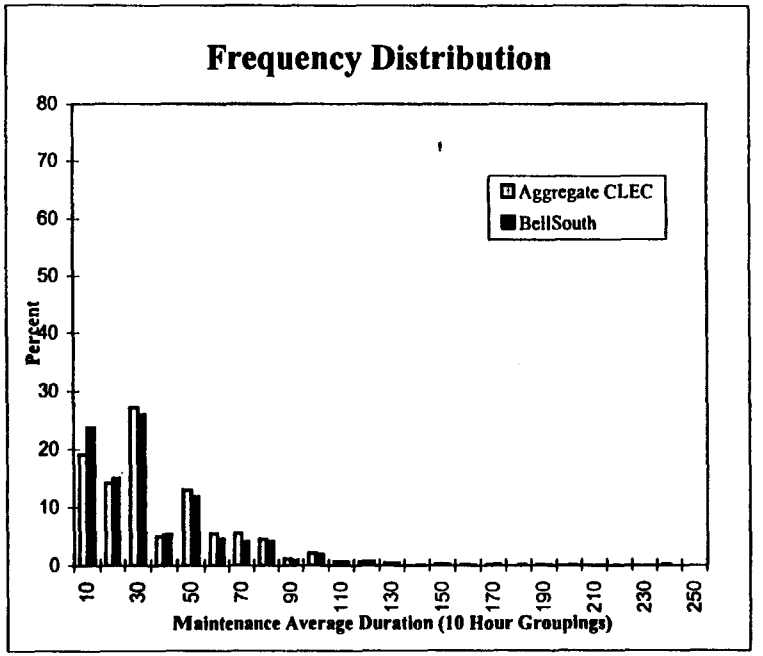
Service Provider	Mean	Standard Deviation
BST	26.51	27.05
CLEC	27.89	27.48
Difference	-1.38	

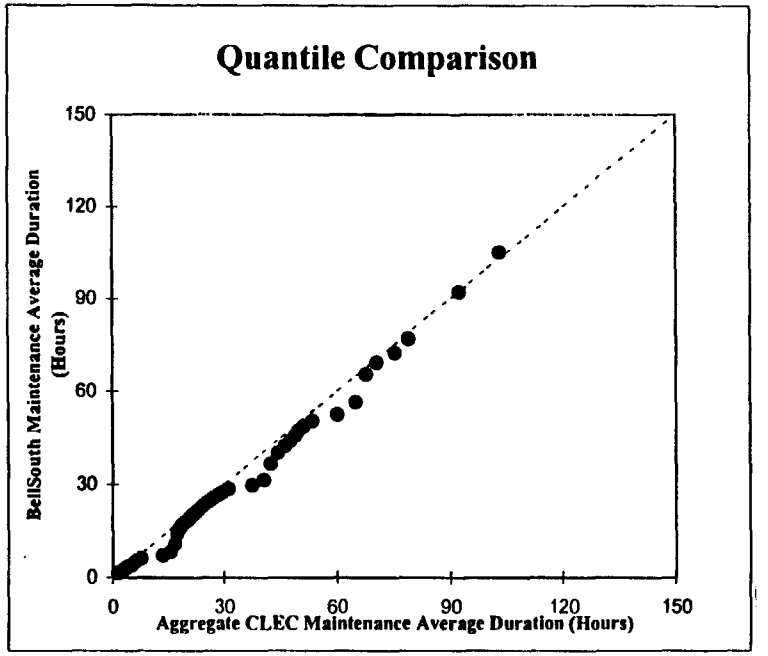
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.91	2.7770
FCC	-1.91	2.7809
BST	-1.93	3.1656

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched





Descriptive Measures

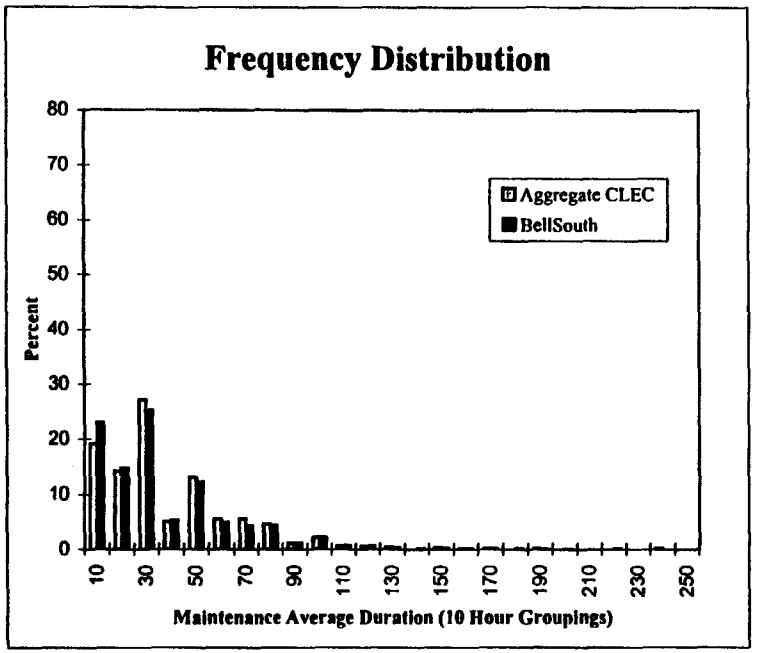
Service Provider	Mean	Standard Deviation
BST	31.01	27.49
CLEC	33.95	28.35
Difference	-2.94	

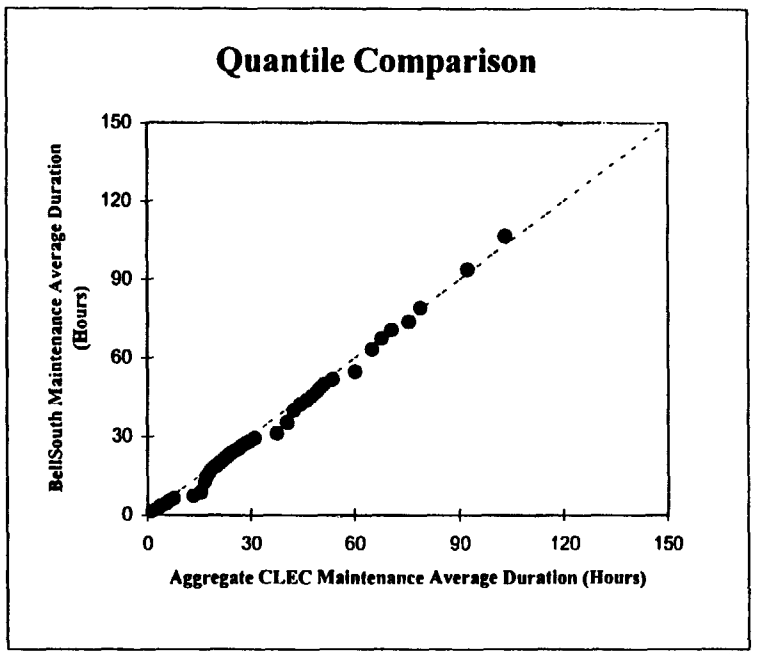
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-3.43	0.0297
FCC	-3.43	0.0300
BST	-2.39	1.1656

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched





Descriptive Measures

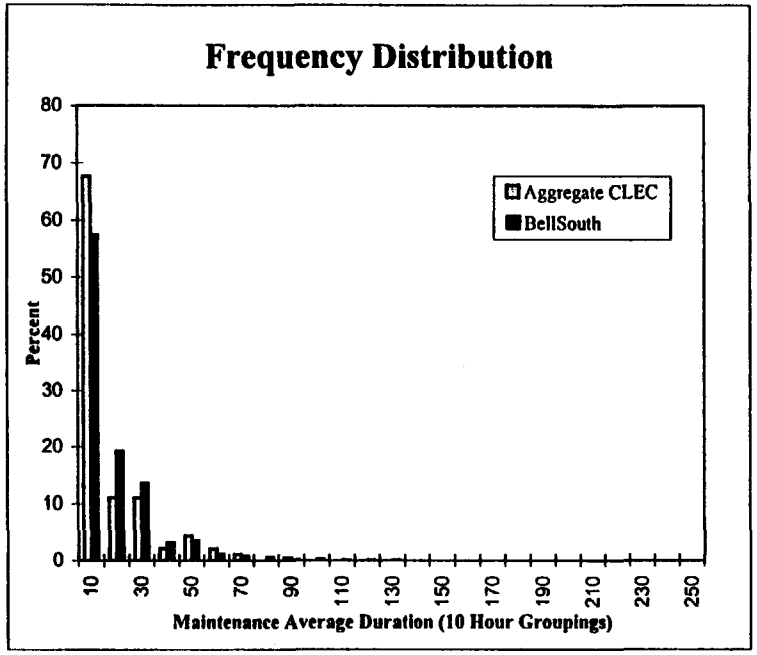
Service Provider	Mean	Standard Deviation
BST	32.05	28.15
CLEC	33.95	28.35
Difference	-1.89	

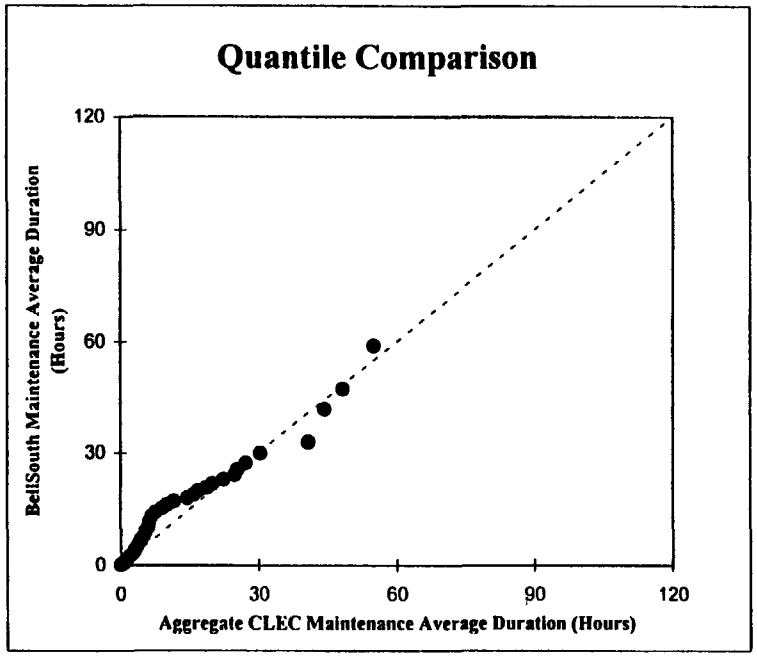
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-2.16	1.5392
FCC	-2.16	1.5406
BST	-2.06	2.4400

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched





Descriptive Measures

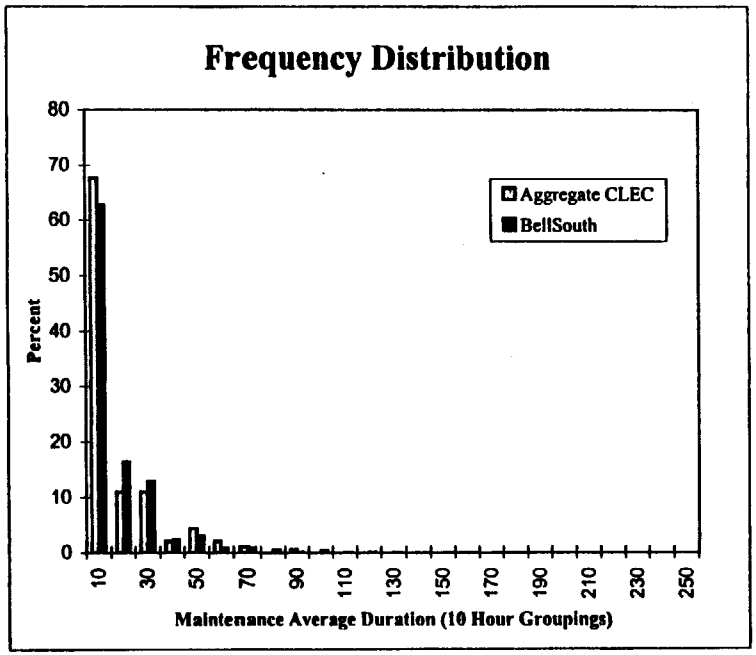
Service Provider	Mean	Standard Deviation
BST	12.43	15.86
CLEC	11.10	15.40
Difference	1.33	

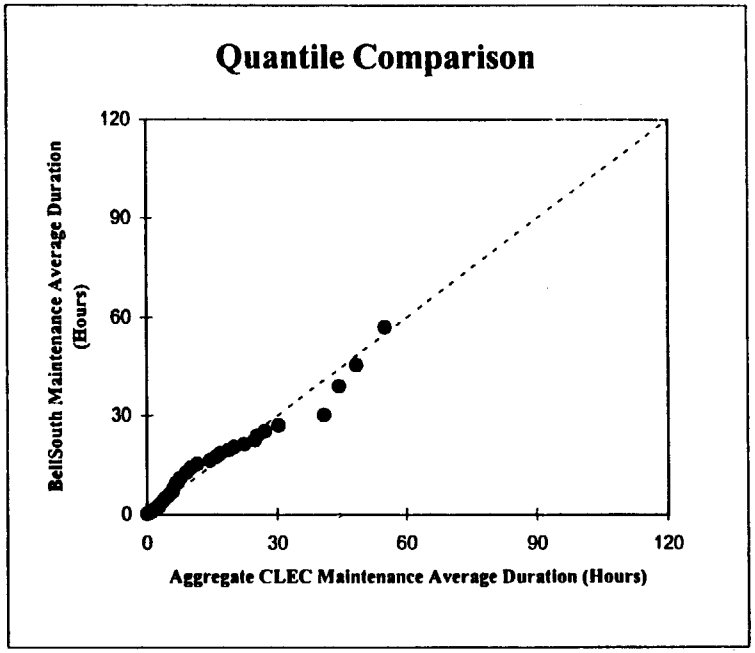
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	1.63	5.1465
FCC	1.63	5.1401
BST	1.41	8.4733

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched





Descriptive Measures

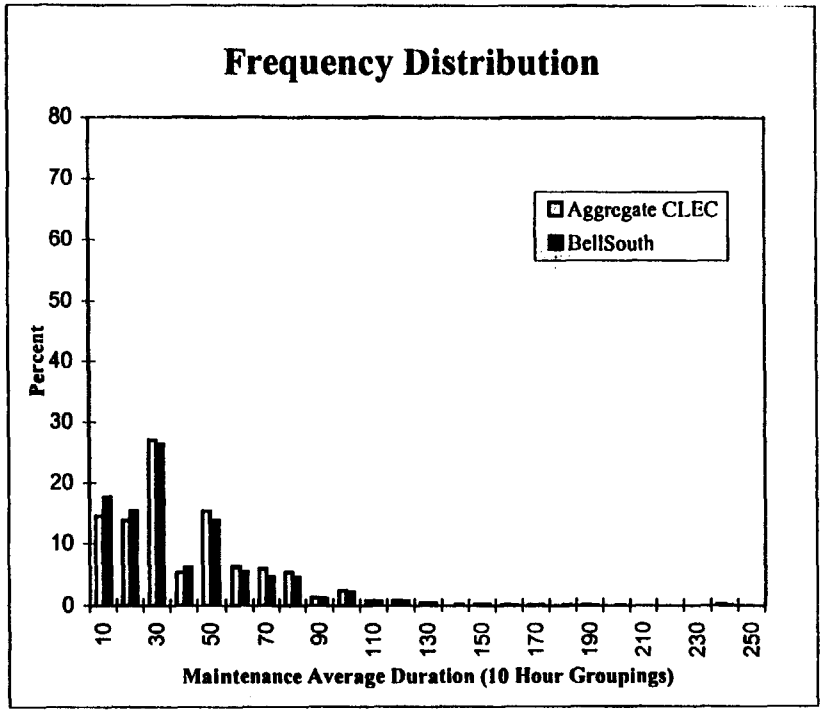
Service Provider	Mean	Standard Deviation
BST	11.11	15.49
CLEC	11.10	15.40
Difference	0.01	

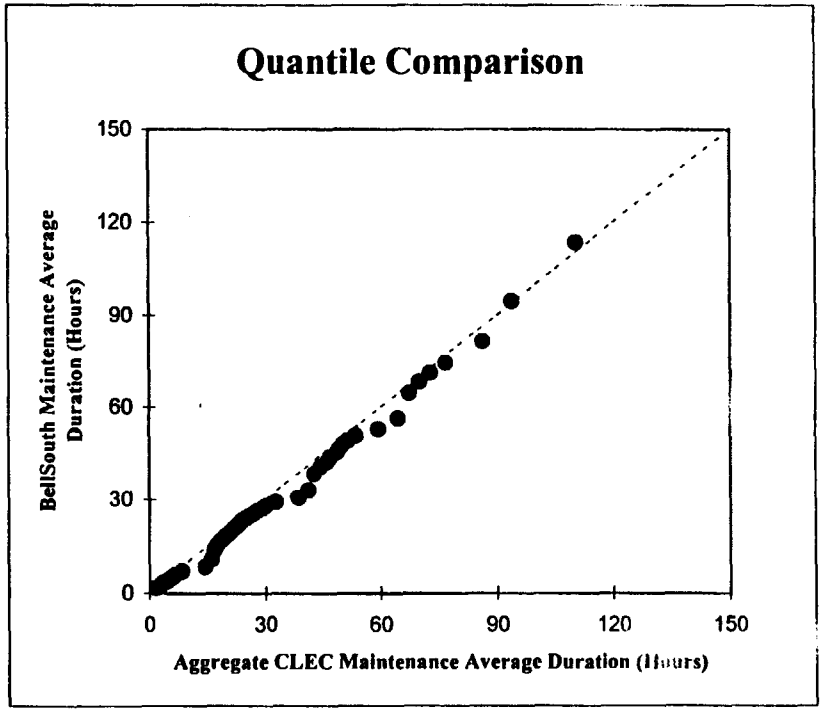
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.01	49.6660
FCC	0.01	49.6660
BST	-0.01	49.6851

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Residential





Descriptive Measures

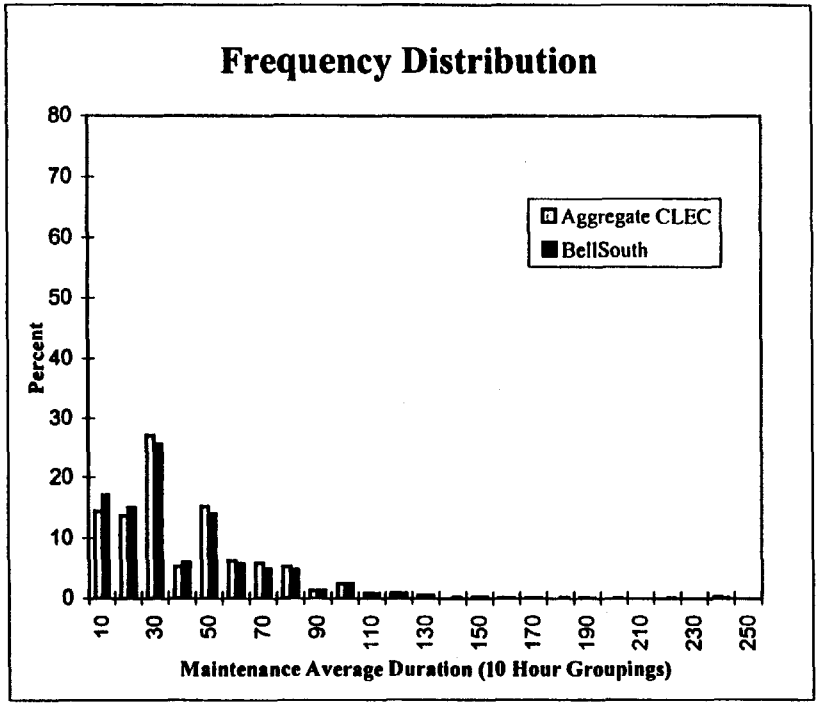
Service Provider	Mean	Standard Deviation
BST	34.08	27.85
CLEC	36.77	28.75
Difference	-2.69	

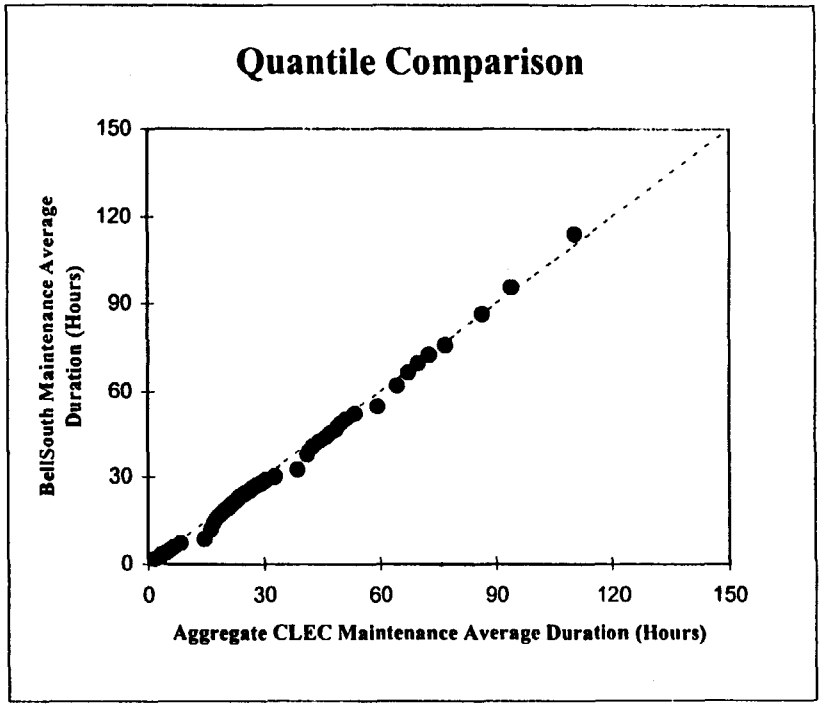
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-2.81	0.2511
FCC	-2.80	0.2529
BST	-2.29	1.4590

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Residential





Descriptive Measures

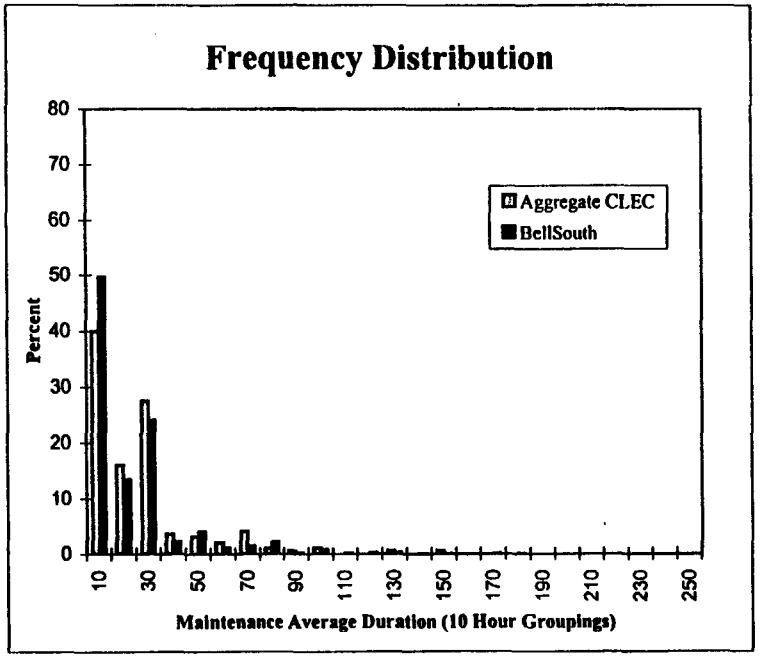
Service Provider	Mean	Standard Deviation
BST	35.05	28.44
CLEC	36.77	28.75
Difference	-1.73	

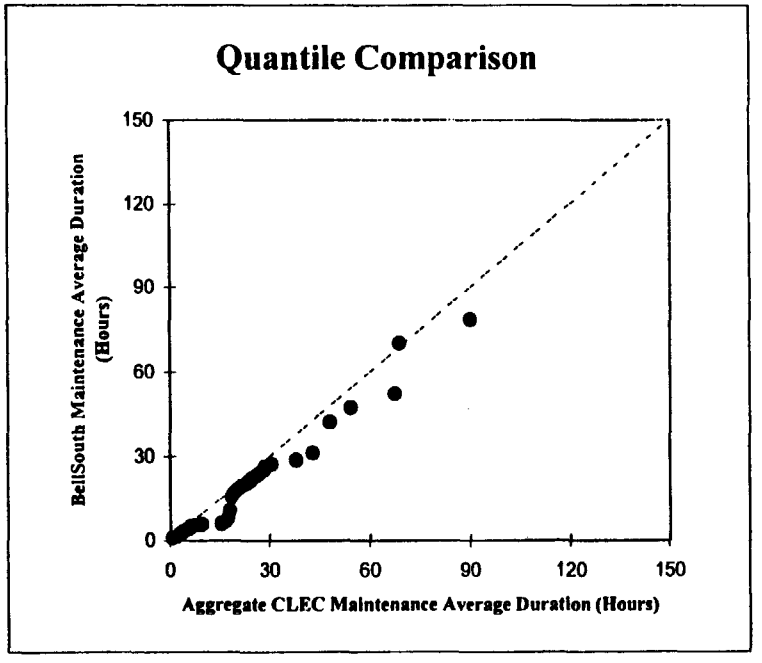
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.76	3.9116
FCC	-1.76	3.9157
BST	-1.80	4.1290

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Business





Descriptive Measures

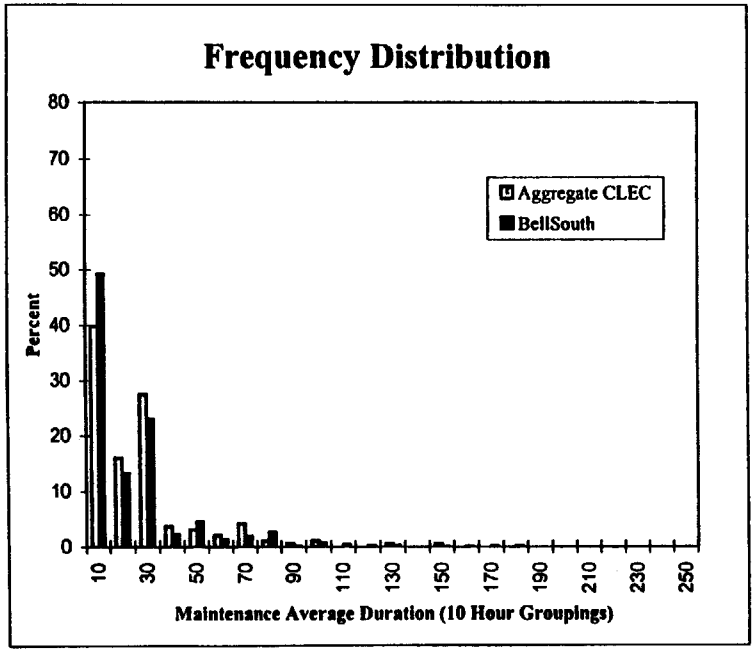
Service Provider	Mean	Standard Deviation
BST	17.77	21.29
CLEC	21.29	22.49
Difference	-3.51	

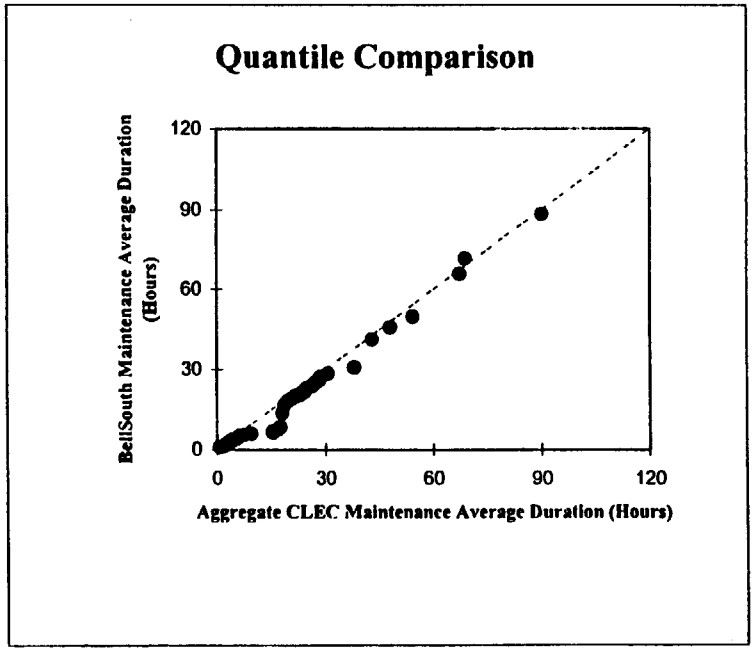
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-2.27	1.1700
FCC	-2.26	1.1795
BST	-1.31	10.0863

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Business





Descriptive Measures

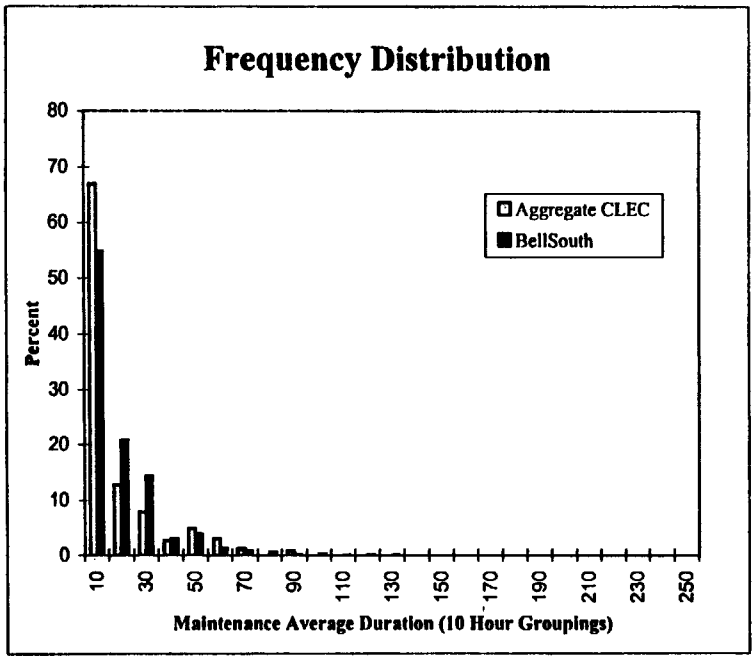
Service Provider	Mean	Standard Deviation
BST	18.64	22.41
CLEC	21.29	22.49
Difference	-2.65	

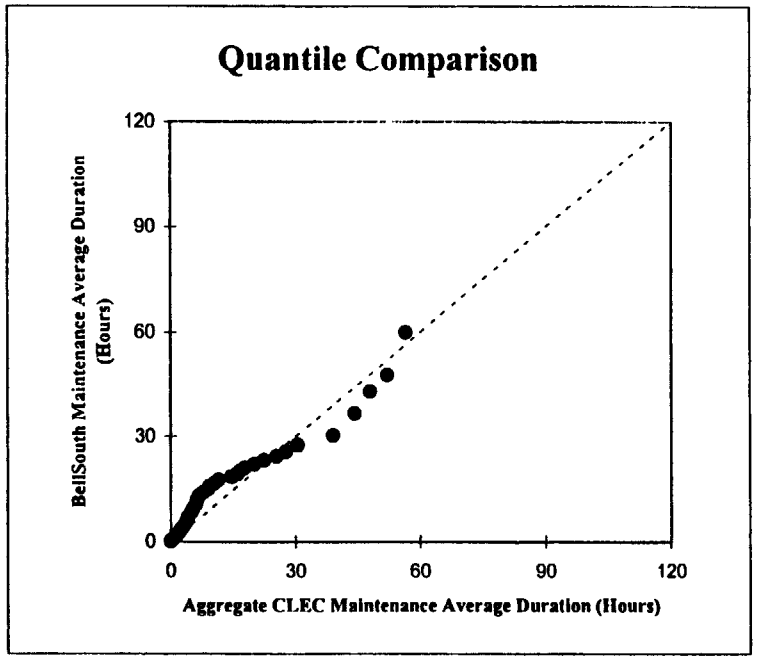
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.62	5.2464
FCC	-1.62	5.2479
BST	-0.89	19.0851

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Residential





Descriptive Measures

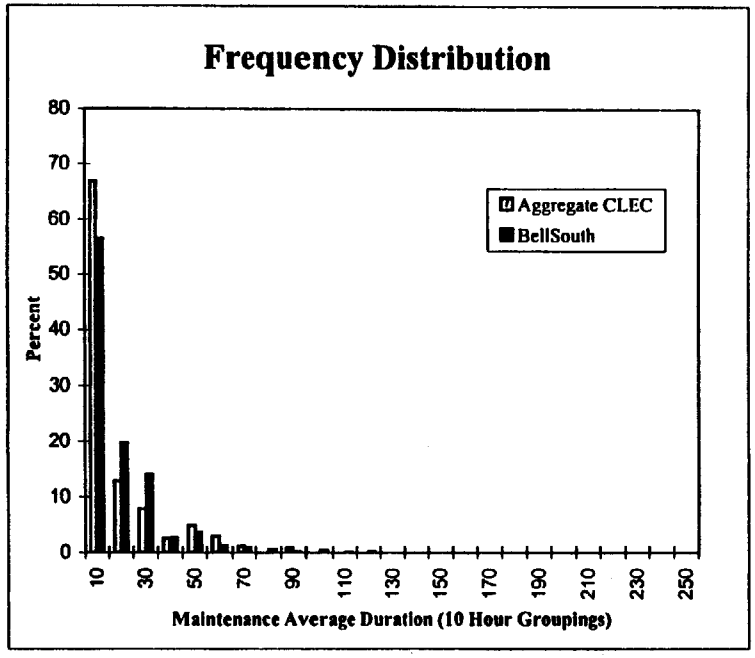
Service Provider	Mean	Standard Deviation
BST	13.06	15.99
CLEC	11.80	16.46
Difference	1.26	

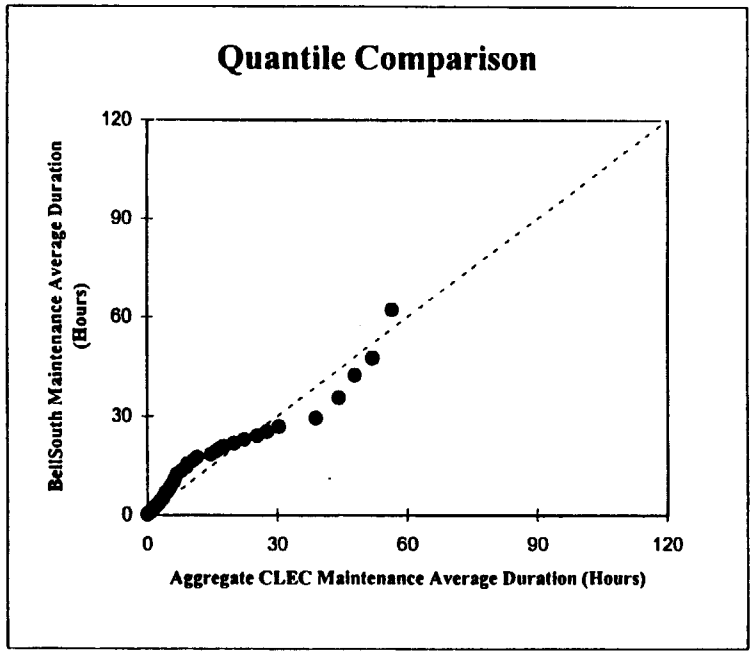
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	1.28	10.0934
FCC	1.28	10.1005
BST	1.04	15.2765

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Residential





Descriptive Measures

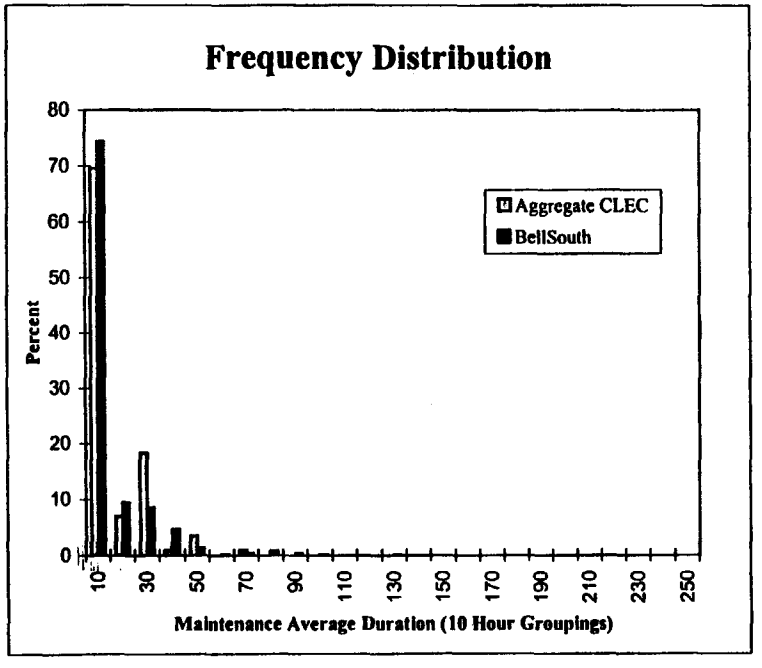
Service Provider	Mean	Standard Deviation
BST	12.74	16.05
CLEC	11.80	16.46
Difference	0.94	

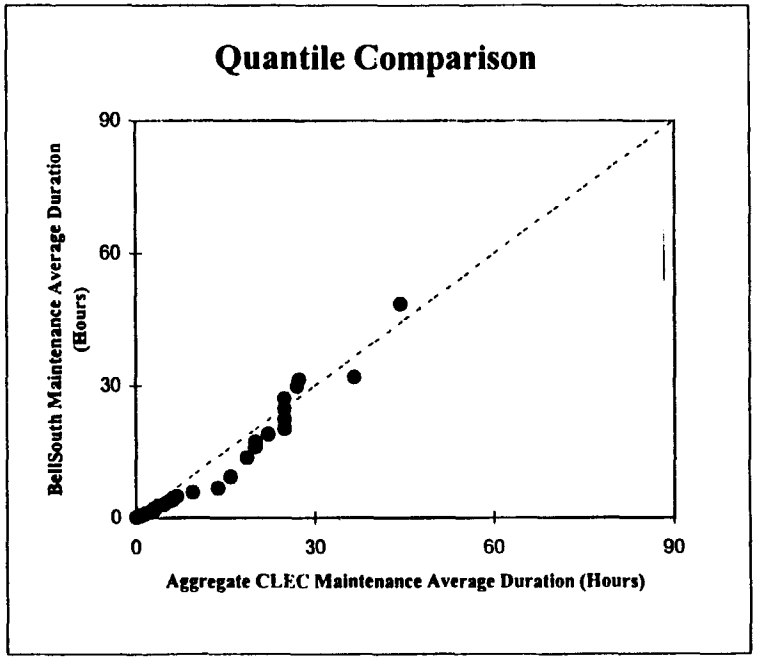
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.95	17.1340
FCC	0.95	17.1407
BST	0.79	21.8735

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Business





Descriptive Measures

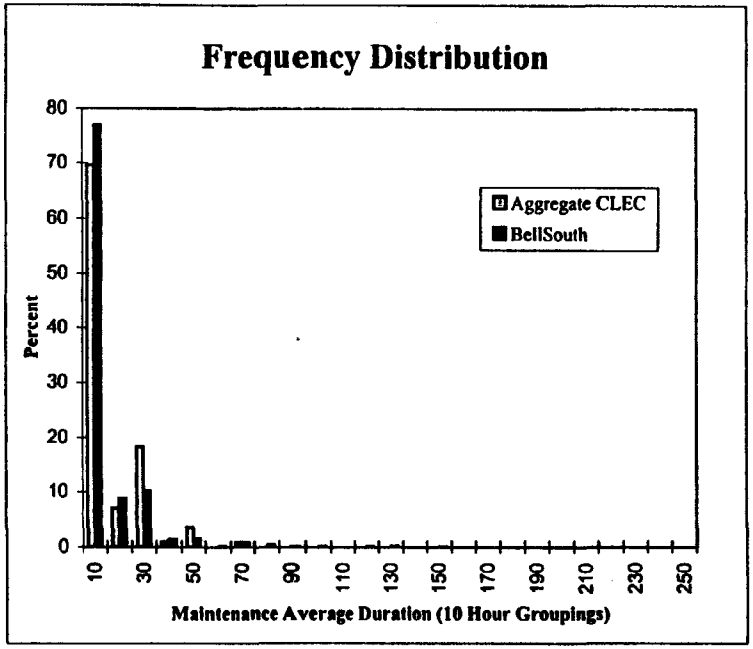
Service Provider	Mean	Standard Deviation
BST	8.44	14.42
CLEC	9.47	12.52
Difference	-1.04	

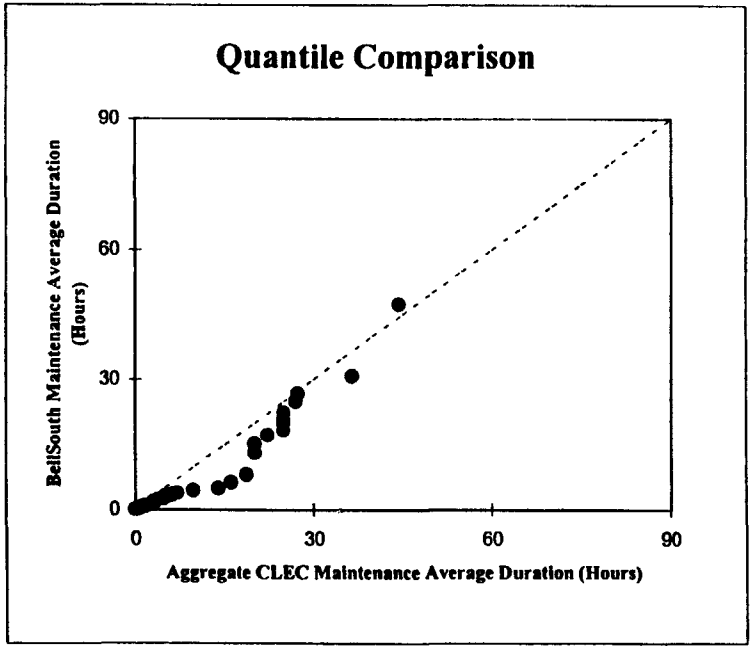
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-0.76	22.3585
FCC	-0.76	22.2793
BST	-0.97	17.0505

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Business





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	7.34	13.46
CLEC	9.47	12.52
Difference	-2.13	

Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.68	4.6902
FCC	-1.68	4.6589
BST	-1.55	6.7569

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

RESALE SERVICES - RESELLER: AGG - CLEC Aggregate

Report Period: 08/01/1998 to 08/31/1998

SQM: Maintenance Average Duration
Non-detailed Report

	Residence			Business			Res + Bus		
	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total
ALABAMA	36.71	9.40	29.77	14.61	9.79	12.89	30.84	9.55	24.79
FLORIDA	26.53	12.08	20.97	18.84	12.55	16.04	24.00	12.26	19.24
GEORGIA	28.51	14.37	24.00	14.35	7.60	11.79	25.93	12.84	21.60
KENTUCKY	28.58	14.63	25.21	21.58	10.69	17.49	26.63	12.97	22.74
LOUISIANA	36.77	11.80	30.90	21.29	9.47	16.88	33.95	11.10	27.89
MISSISSIPPI	37.11	9.10	27.71	13.97	1.74	10.91	36.14	8.90	27.09
NORTH CAROLINA	45.76	14.19	33.85	28.77	11.89	21.28	40.83	13.38	29.90
SOUTH CAROLINA	34.98	9.97	25.18	26.28	9.23	20.35	33.03	9.82	24.16
TENNESSEE	52.69	19.43	43.82	18.22	14.85	16.62	47.93	18.13	38.86
REGION	33.14	12.81	26.45	19.12	10.97	15.76	29.94	12.26	23.76

NA = Not Applicable (NA indicates measurements that do not apply to the particular measure)
Blank cells occur as a result of either no activity or when a divide by zero error would result.

RETAIL SERVICES: BST - BST Aggregate

Report Period: 08/01/1998 to 08/31/1998

SQM: Maintenance Average Duration
Non-detailed Report

	Residence			Business			Res + Bus		
	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total
ALABAMA	33.79	14.20	26.45	12.06	7.87	10.77	29.98	13.34	23.92
FLORIDA	28.05	13.39	21.90	17.08	9.29	14.08	25.55	12.55	20.19
GEORGIA	27.57	15.29	22.70	14.10	8.67	12.26	24.68	14.12	20.62
KENTUCKY	38.07	18.36	31.26	19.36	6.94	15.77	35.20	16.96	29.04
LOUISIANA	34.08	13.06	25.21	17.77	8.44	14.69	31.01	12.43	23.45
MISSISSIPPI	33.55	12.11	25.18	10.30	4.79	8.54	29.53	11.14	22.55
NORTH CAROLINA	43.87	15.03	31.48	25.59	10.46	20.40	40.03	14.32	29.40
SOUTH CAROLINA	35.50	12.88	27.06	24.84	11.68	20.72	33.34	12.68	25.87
TENNESSEE	60.00	23.64	44.88	20.64	9.00	16.93	53.54	21.97	40.85
REGION	35.97	15.36	27.63	17.70	8.97	14.69	32.32	14.33	25.24

NA = Not Applicable (NA indicates measurements that do not apply to the particular measure)
Blank cells occur as a result of either no activity or when a divide by zero error would result.

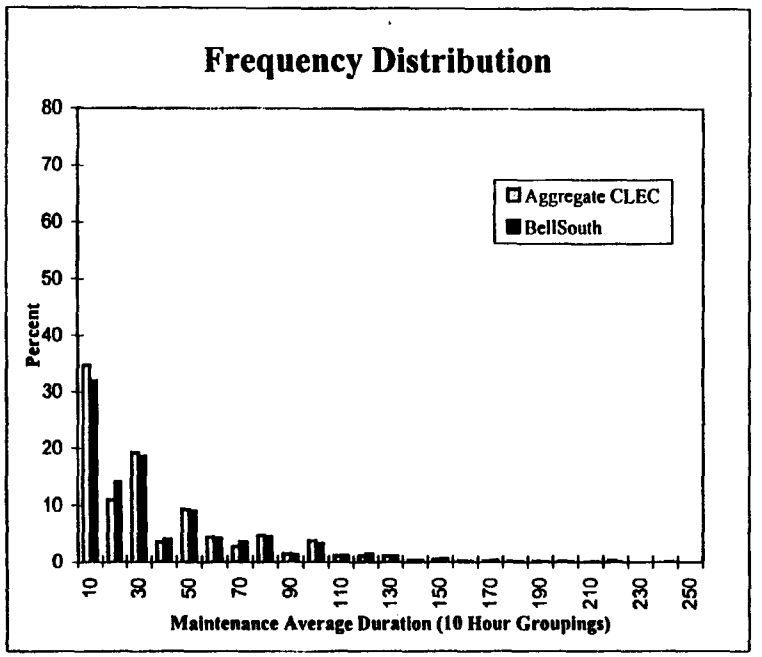
Appendix F
Maintenance Average Duration (MAD) - September Graphics

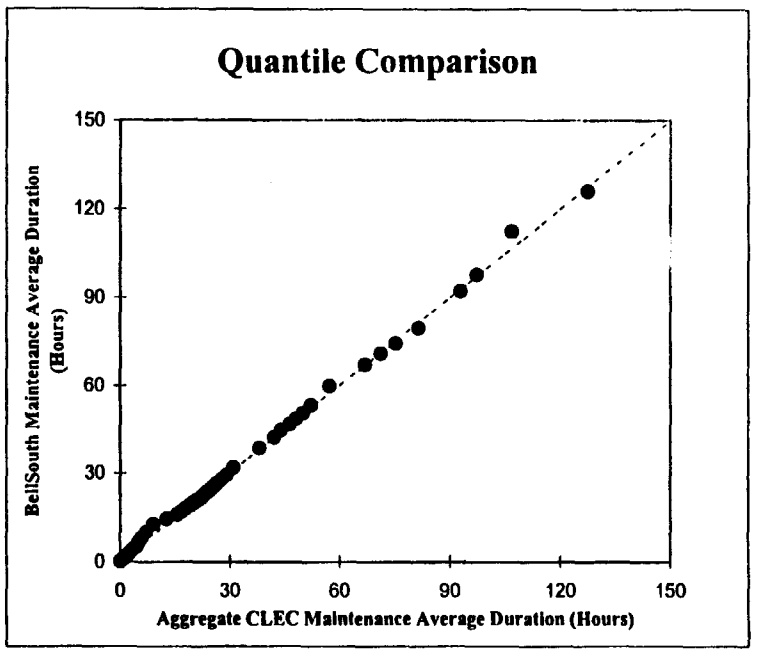
I. Graphical Representations

Unadjusted		Adjusted	
1. All Cases	F-1	1. All Cases	F-2
2. Dispatched	F-3	2. Dispatched	F-4
3. Non-Dispatched	F-5	3. Non-Dispatched	F-6
4. Dispatched, Residential	F-7	4. Dispatched, Residential	F-8
5. Dispatched, Business	F-9	5. Dispatched, Business	F-10
6. Non-Dispatched, Residential	F-11	6. Non-Dispatched, Residential	F-12
7. Non-Dispatched, Business	F-13	7. Non-Dispatched, Business	F-14

II. SQM F-15

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, All Cases





Descriptive Measures

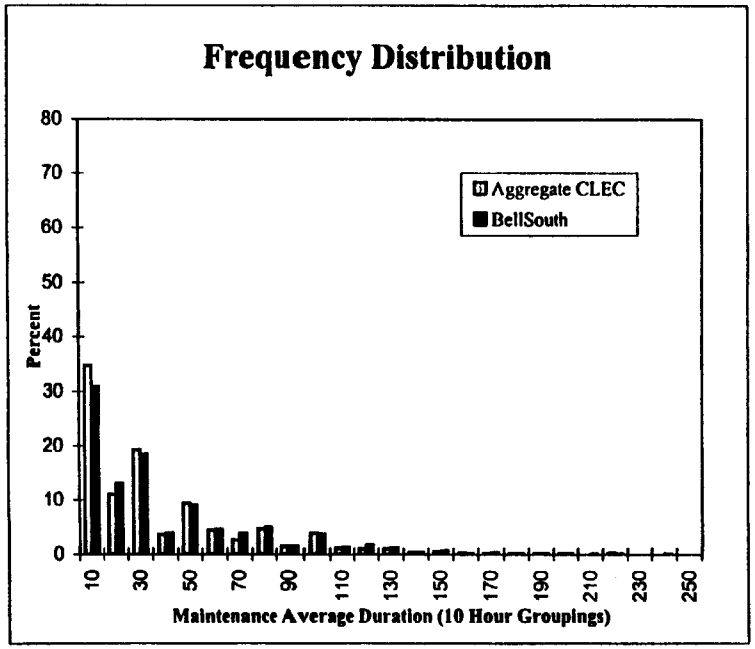
Service Provider	Mean	Standard Deviation
BST	32.42	34.46
CLEC	32.23	35.15
Difference	0.19	

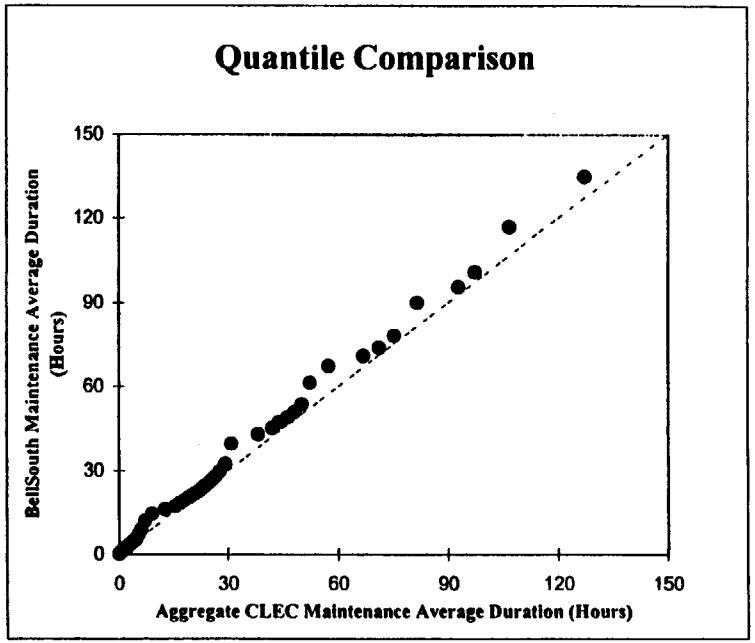
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.24	40.5990
FCC	0.24	40.6031
BST	0.15	44.1390

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, All Cases





Descriptive Measures

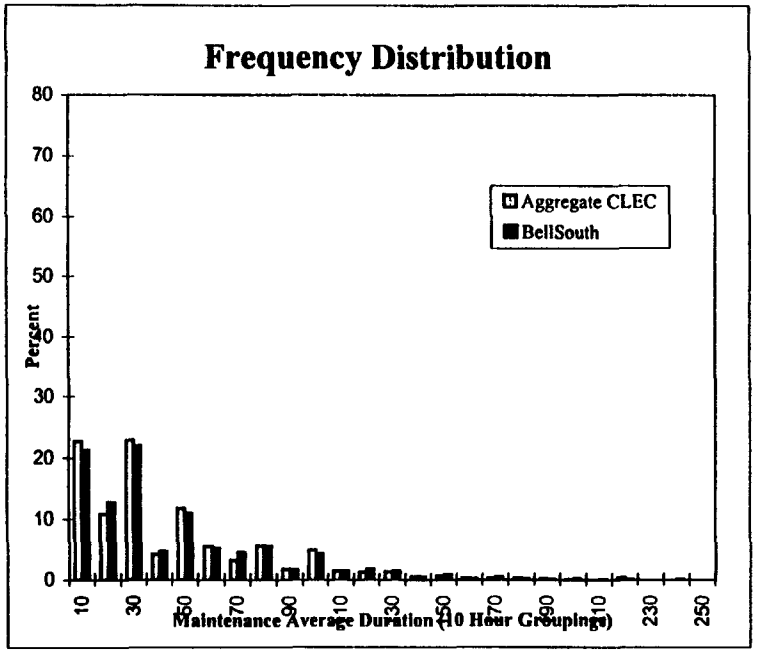
Service Provider	Mean	Standard Deviation
BST	34.55	36.23
CLEC	32.23	35.15
Difference	2.32	

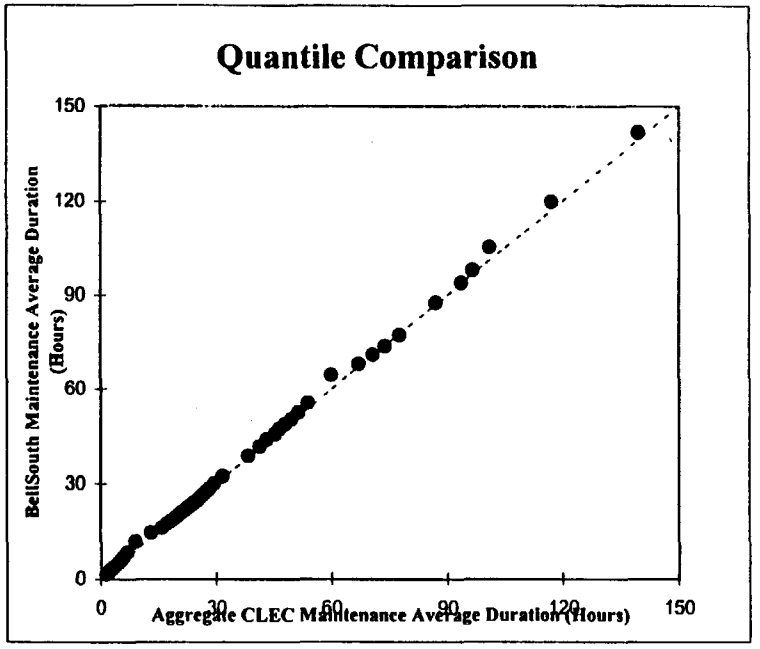
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.81	0.2448
FCC	2.82	0.2435
BST	2.43	1.0729

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched





Descriptive Measures

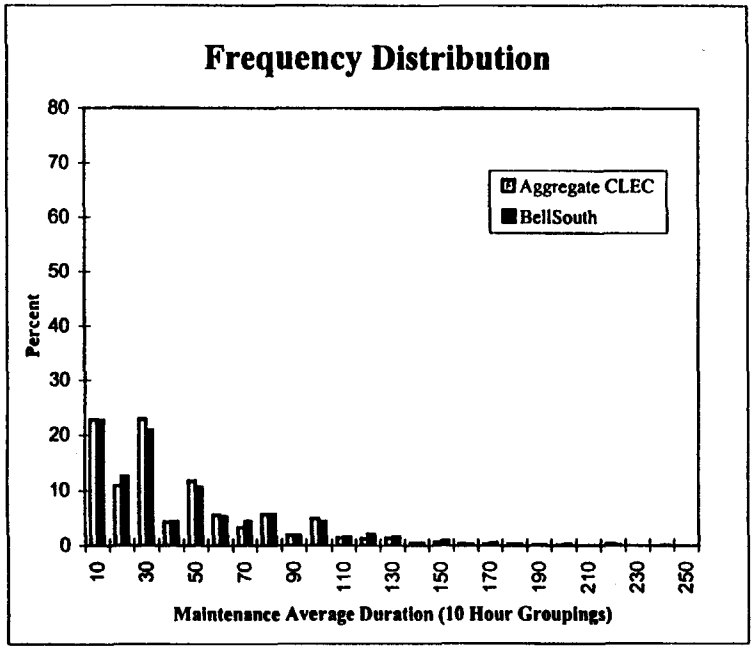
Service Provider	Mean	Standard Deviation
BST	39.67	36.37
CLEC	39.11	36.09
Difference	0.56	

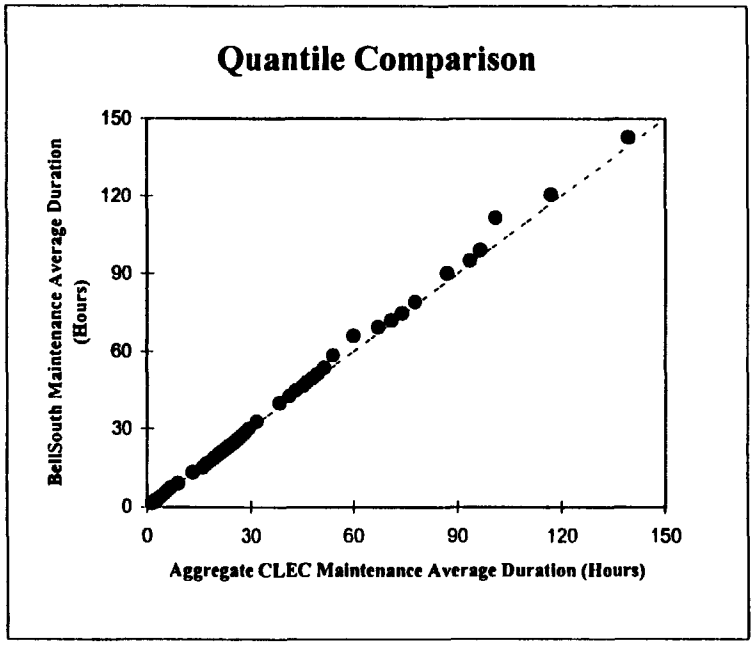
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.58	28.2469
FCC	0.58	28.2431
BST	0.38	35.4005

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched





Descriptive Measures

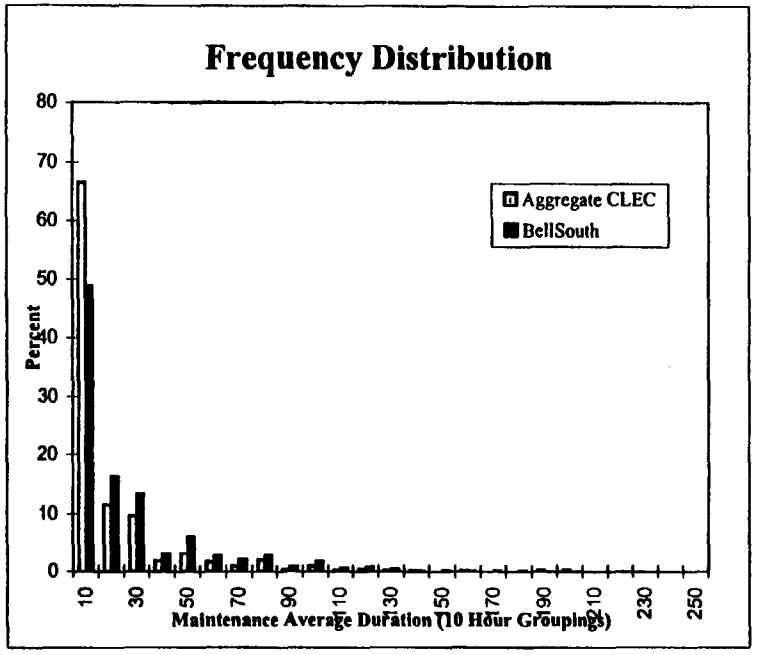
Service Provider	Mean	Standard Deviation
BST	39.94	37.28
CLEC	39.11	36.09
Difference	0.83	

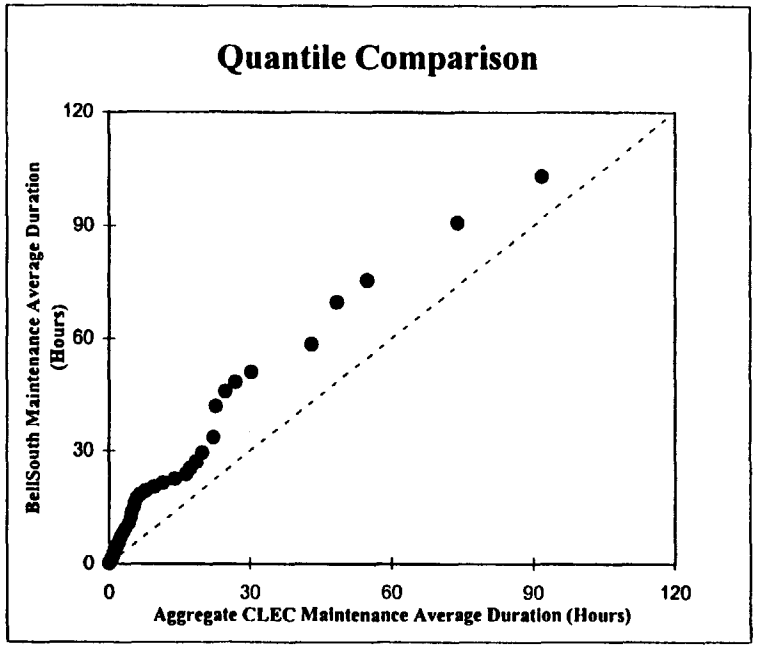
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.83	20.2465
FCC	0.83	20.2276
BST	0.68	25.0975

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched





Descriptive Measures

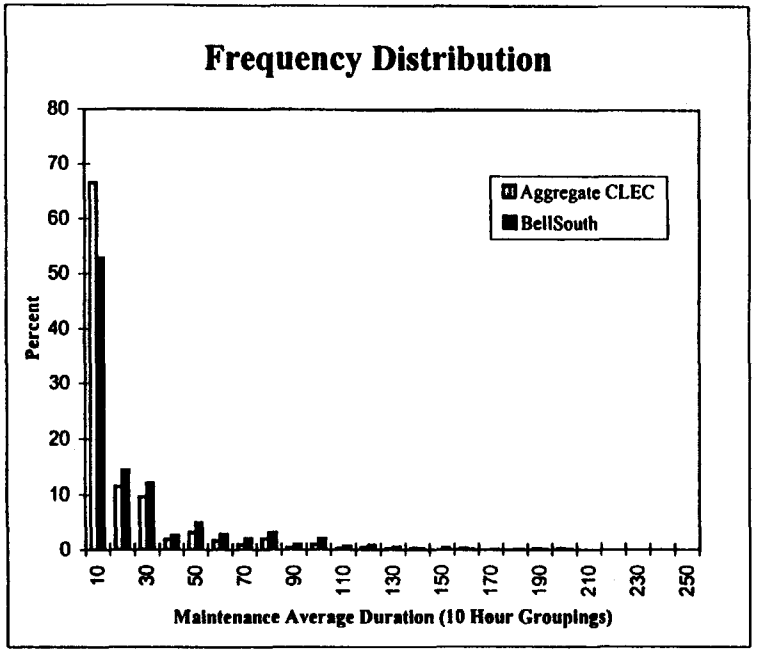
Service Provider	Mean	Standard Deviation
BST	20.94	27.55
CLEC	14.01	24.52
Difference	6.92	

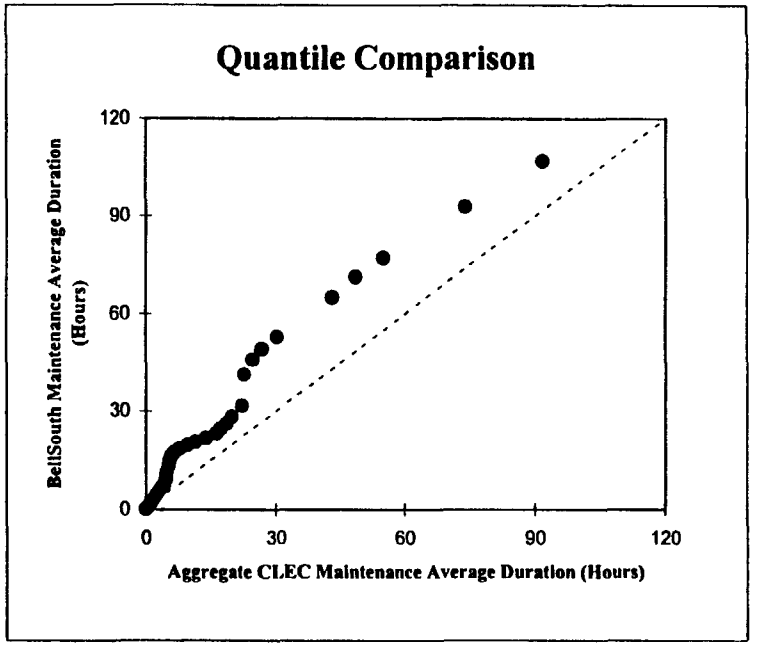
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.79	0.0000
FCC	5.80	0.0000
BST	4.78	0.0023

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched





Descriptive Measures

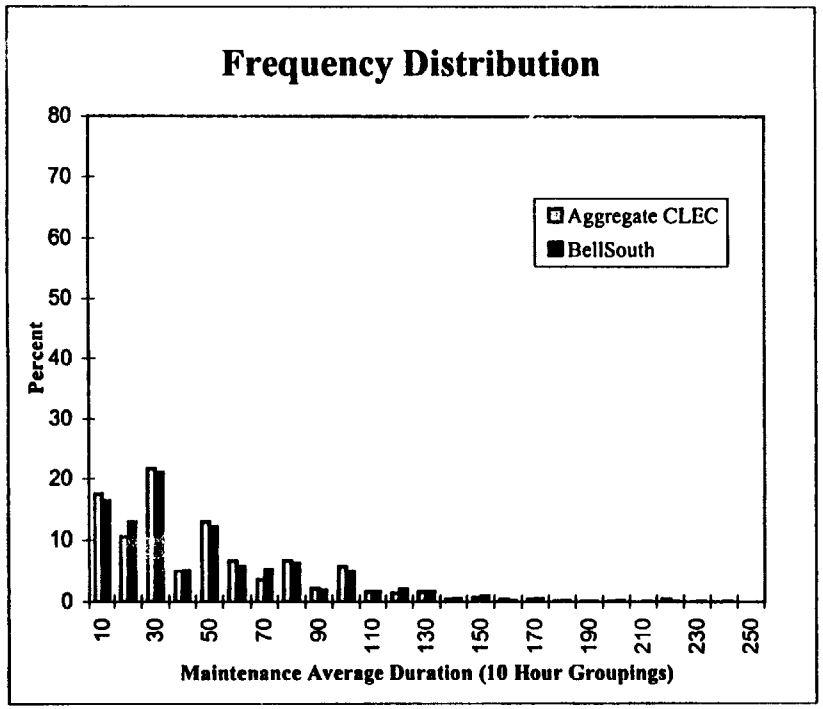
Service Provider	Mean	Standard Deviation
BST	20.31	28.79
CLEC	14.01	24.52
Difference	6.30	

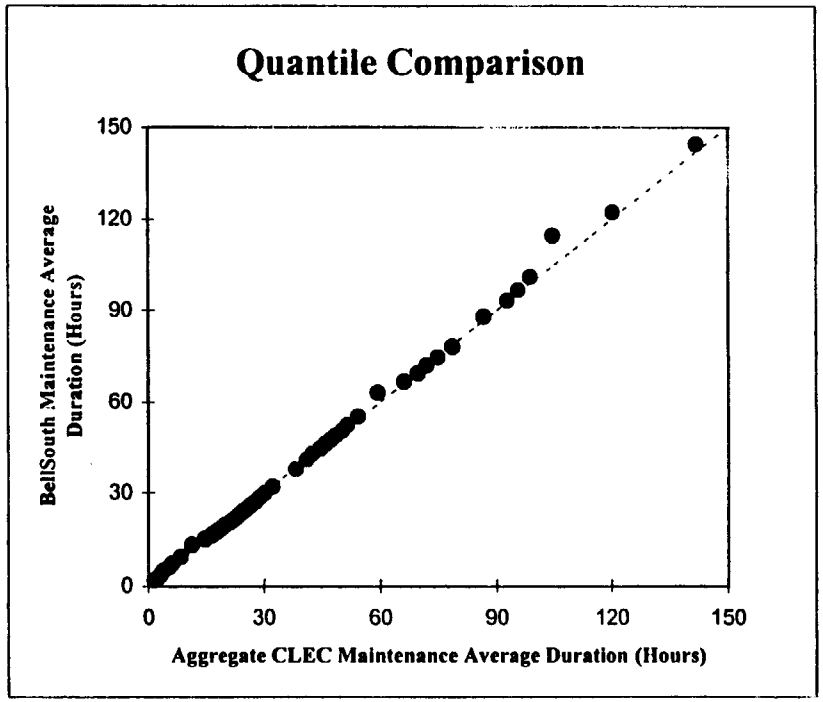
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.05	0.0000
FCC	5.06	0.0000
BST	5.55	0.0003

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Residential





Descriptive Measures

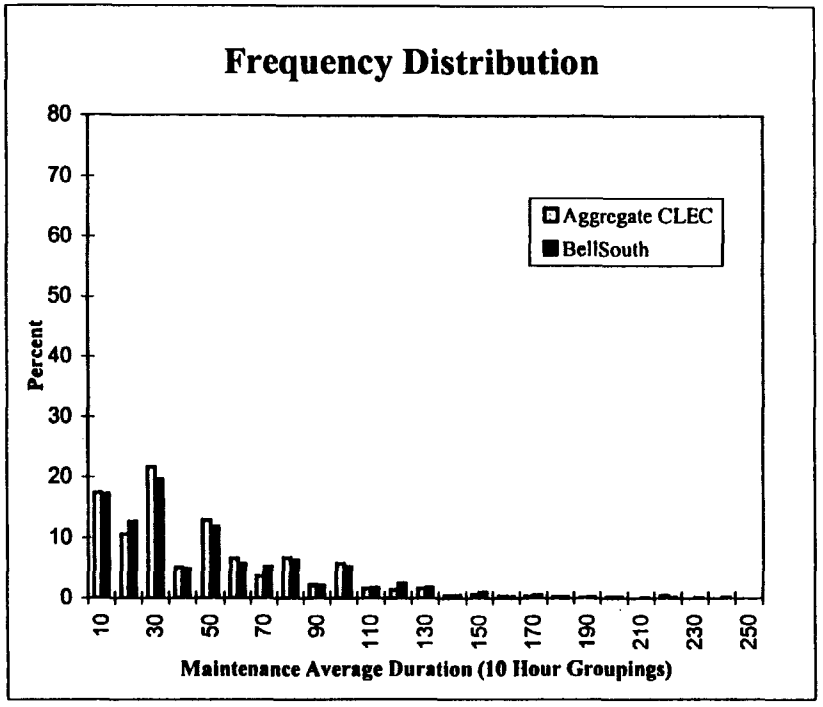
Service Provider	Mean	Standard Deviation
BST	43.69	37.27
CLEC	43.41	36.81
Difference	0.28	

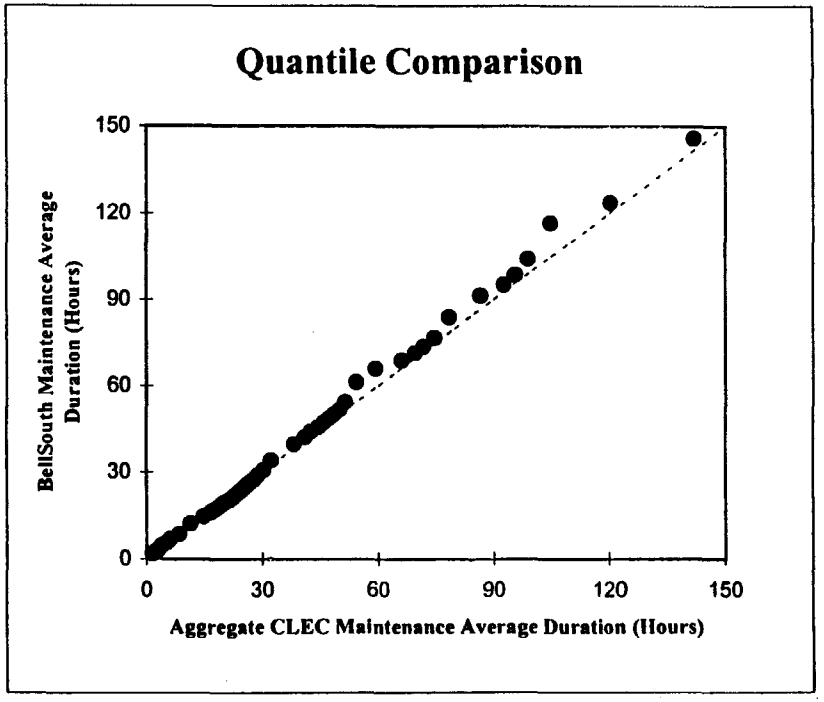
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.24	40.3751
FCC	0.24	40.3723
BST	0.14	44.3989

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Residential





Descriptive Measures

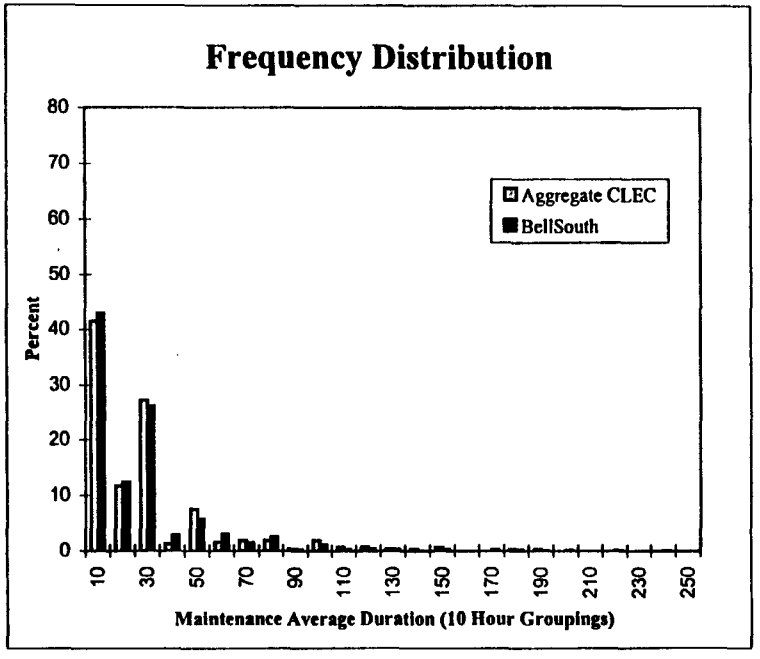
Service Provider	Mean	Standard Deviation
BST	44.73	38.50
CLEC	43.41	36.81
Difference	1.32	

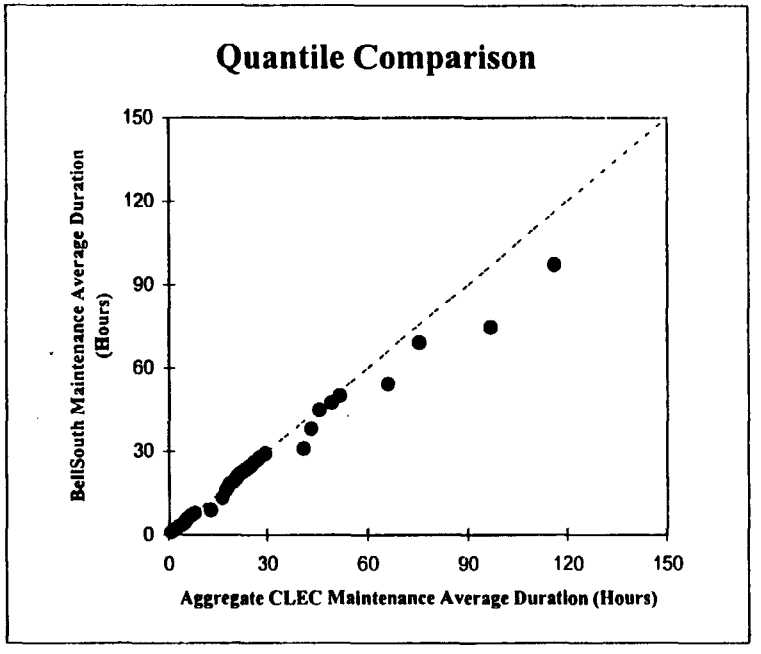
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	1.13	12.8696
FCC	1.13	12.8447
BST	0.99	16.5790

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Business





Descriptive Measures

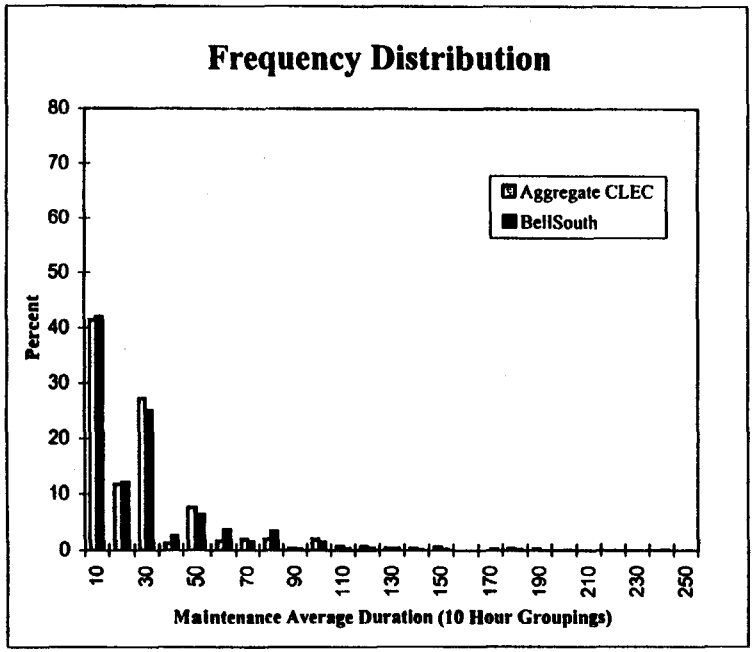
Service Provider	Mean	Standard Deviation
BST	21.78	25.18
CLEC	23.90	28.70
Difference	-2.12	

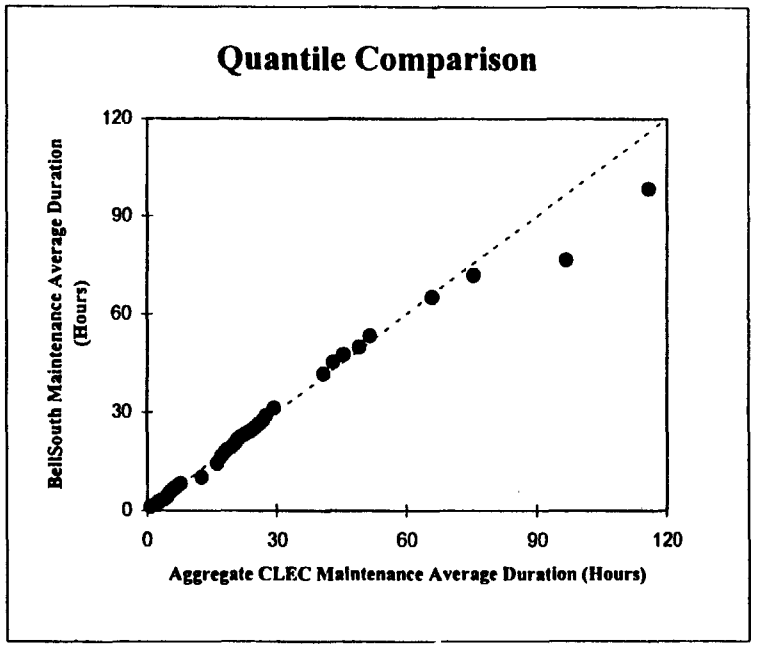
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.47	7.0112
FCC	-1.47	7.1016
BST	-0.89	18.9309

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Dispatched, Business





Descriptive Measures

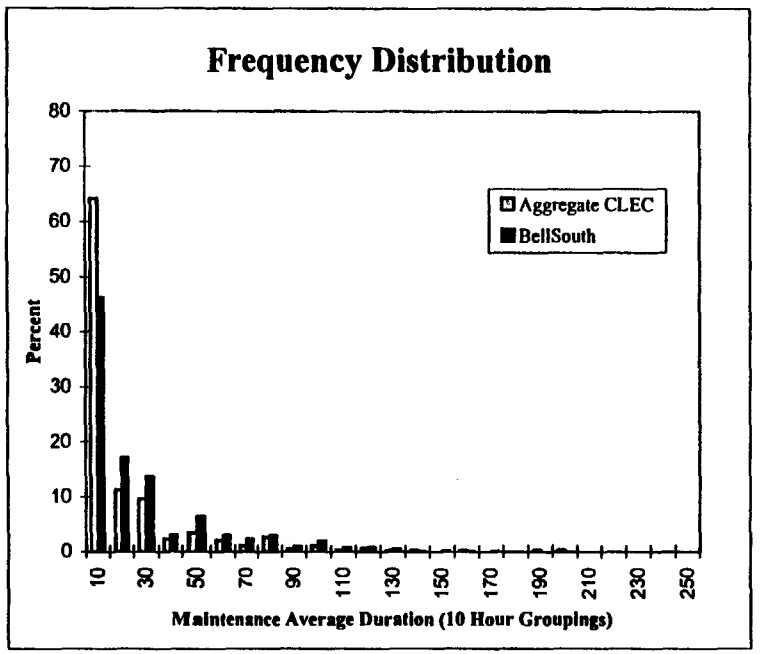
Service Provider	Mean	Standard Deviation
BST	22.98	26.44
CLEC	23.90	28.70
Difference	-0.92	

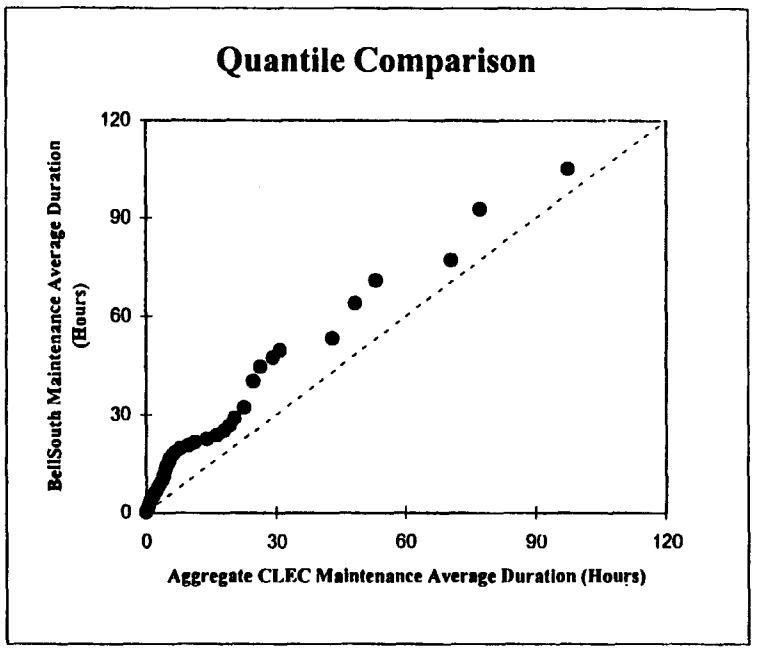
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-0.61	27.0616
FCC	-0.61	27.1166
BST	-0.41	34.1136

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Residential





Descriptive Measures

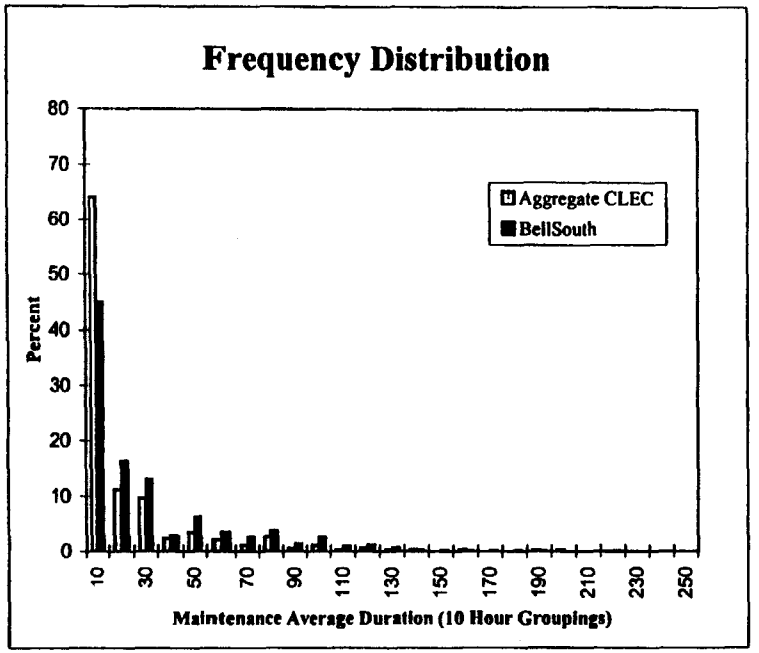
Service Provider	Mean	Standard Deviation
BST	22.15	28.12
CLEC	15.99	27.27
Difference	6.16	

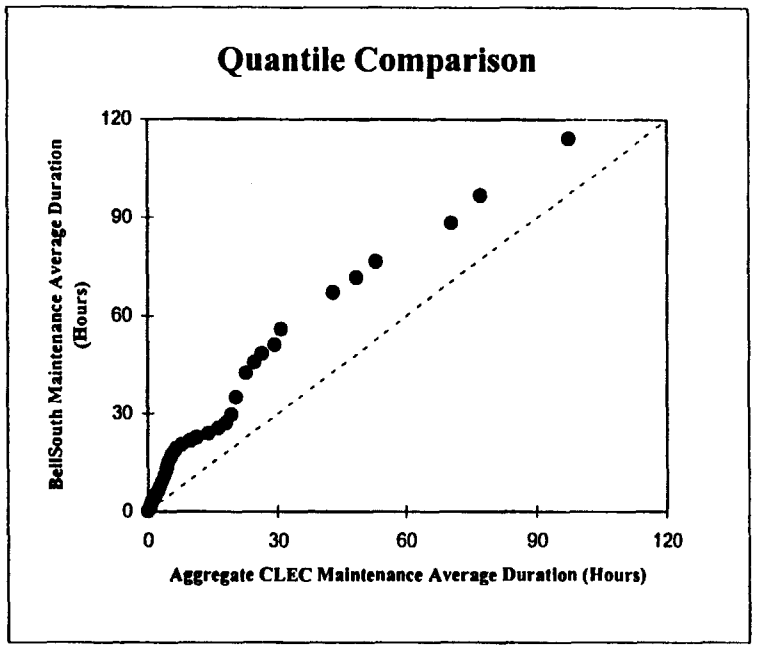
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	4.26	0.0010
FCC	4.27	0.0010
BST	3.36	0.1111

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Residential





Descriptive Measures

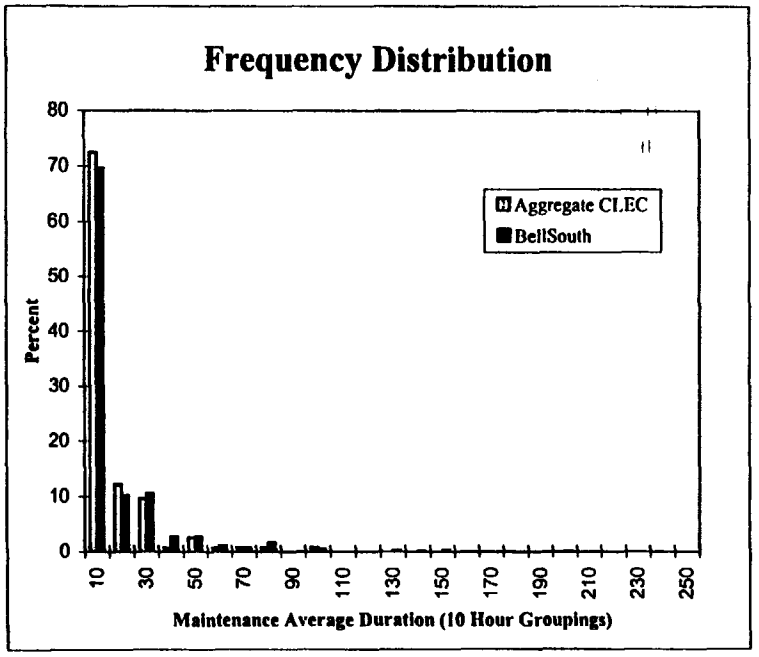
Service Provider	Mean	Standard Deviation
BST	24.24	30.70
CLEC	15.99	27.27
Difference	8.25	

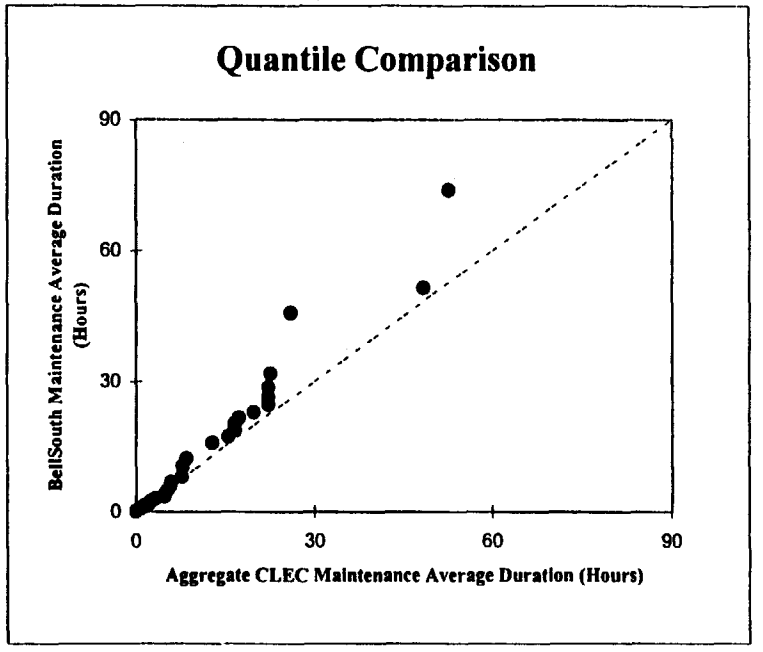
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	5.23	0.0000
FCC	5.24	0.0000
BST	5.30	0.0005

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Business





Descriptive Measures

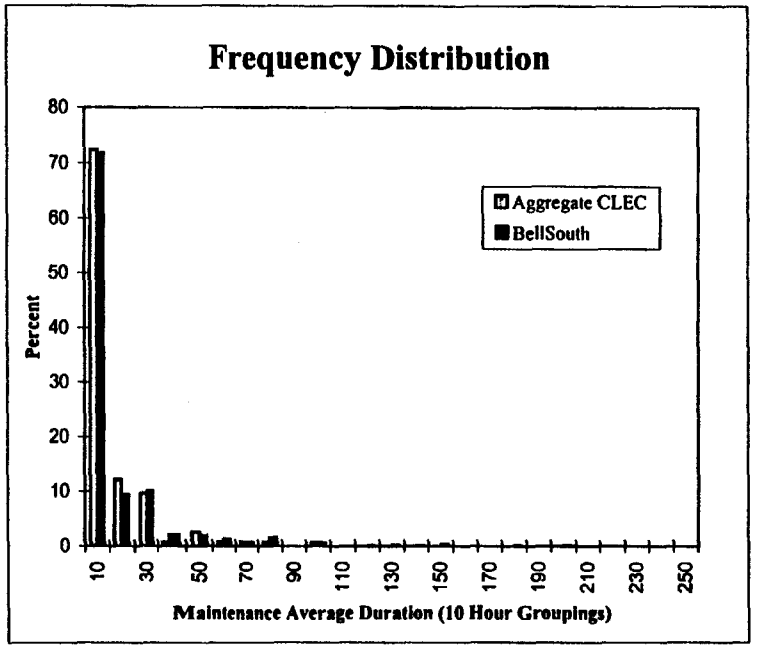
Service Provider	Mean	Standard Deviation
BST	11.03	19.81
CLEC	9.13	14.84
Difference	1.90	

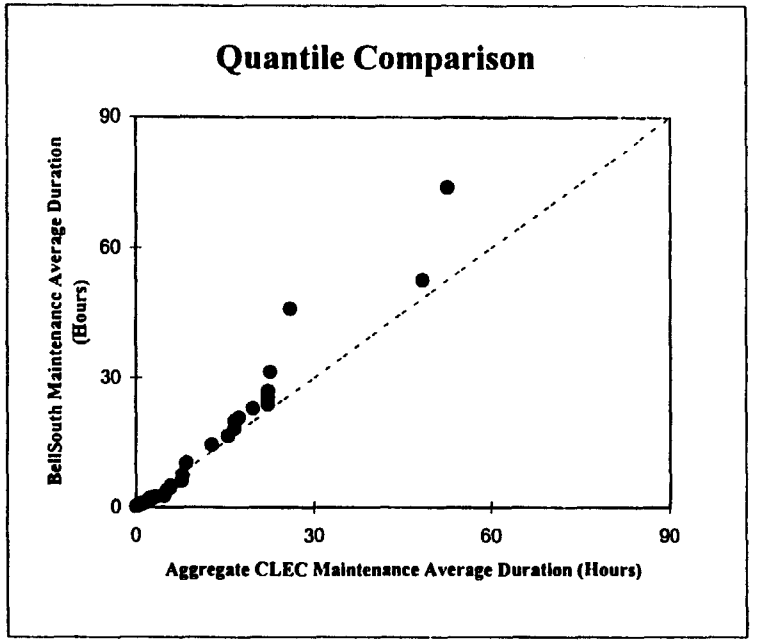
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	1.18	11.9778
FCC	1.19	11.7718
BST	0.89	19.1858

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Non-Designed, Non-Dispatched, Business





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	10.64	20.56
CLEC	9.13	14.84
Difference	1.51	

Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.90	18.4693
FCC	0.91	18.2394
BST	0.51	30.8961

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

RESALE SERVICES - RESELLER: AGG - CLEC Aggregate

Report Period: 09/01/1998 to 09/30/1998

SQM: Maintenance Average Duration
Non-detailed Report

	Residence			Business			Res + Bus		
	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total
ALABAMA	37.10	11.67	30.21	16.68	5.35	12.94	30.80	9.32	24.56
FLORIDA	25.10	10.83	19.14	18.71	8.51	14.41	23.30	10.17	17.80
GEORGIA	26.25	10.66	21.06	15.56	14.28	15.03	24.35	11.50	19.87
KENTUCKY	25.08	9.36	20.74	16.42	5.31	10.96	22.19	7.10	16.67
LOUISIANA	43.41	15.99	36.39	23.90	9.13	19.02	39.11	14.01	32.23
MISSISSIPPI	43.85	16.65	33.60	9.83	3.97	6.60	42.46	15.64	32.09
NORTH CAROLINA	42.36	12.07	30.32	26.91	9.45	19.11	37.25	11.08	26.39
SOUTH CAROLINA	31.11	11.49	23.42	28.89	12.93	23.40	30.67	11.73	23.41
TENNESSEE	30.89	9.53	25.42	19.24	5.22	15.06	29.17	8.77	23.81
REGION	31.44	11.80	24.51	19.76	9.67	15.66	28.83	11.24	22.40

NA = Not Applicable (NA indicates measurements that do not apply to the particular measure)
Blank cells occur as a result of either no activity or when a divide by zero error would result.

RETAIL SERVICES: BST - BST Aggregate

Report Period: 09/01/1998 to 09/30/1998

SQM: Maintenance Average Duration
Non-detailed Report

	Residence			Business			Res + Bus		
	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total	Dispatched	Non-Disp.	Total
ALABAMA	31.94	16.76	25.29	12.17	9.44	11.29	28.05	15.81	22.92
FLORIDA	26.09	12.56	20.20	16.88	8.19	13.60	23.99	11.73	18.81
GEORGIA	24.98	12.89	20.09	14.36	10.05	12.91	22.64	12.40	18.63
KENTUCKY	27.16	11.18	21.51	17.55	5.56	13.93	25.57	10.41	20.33
LOUISIANA	43.69	22.15	34.91	21.78	11.03	18.84	39.67	20.94	32.42
MISSISSIPPI	36.41	16.31	27.09	10.72	6.99	9.57	31.72	15.35	24.50
NORTH CAROLINA	41.84	12.59	30.62	25.33	9.07	19.86	38.02	11.90	28.27
SOUTH CAROLINA	32.22	11.12	24.38	27.30	11.41	21.96	31.16	11.18	23.88
TENNESSEE	30.21	11.90	22.78	15.03	5.89	12.07	27.41	11.07	21.00
REGION	31.61	14.26	24.43	17.78	8.80	14.75	28.73	13.39	22.60

NA = Not Applicable (NA indicates measurements that do not apply to the particular measure)
Blank cells occur as a result of either no activity or when a divide by zero error would result.

Appendix G
OSS Average Response Interval Calculations and Graphics

I. Descriptive Measures.....G-1

II. Time Series Analysis G-2

Operating Support Services (OSS) Average Response Interval

Descriptive Measures

For a three month period from July to September 1998, daily OSS Response Interval data existed on thirteen systems, four of which were available to both BellSouth and the CLECs. In an attempt to compare the average response interval for BellSouth to the CLECs, we limited our analysis to the four systems for which there were "like-to-like" data. Without the knowledge of the length of each individual call, we were unable to calculate a variance for the average response interval. However, for each day for which there were data, we determined a daily average response interval by taking the total amount of call time and dividing it by the number of calls. The CLEC daily average response intervals were subtracted from the corresponding BellSouth intervals, yielding a series of daily average response interval differences. An overall series was also calculated by averaging together the four sets of daily average response interval difference data. The results of these calculations are presented in Table 1.

Table 1 - Average Response Intervals and Differences (milliseconds)

Overall

Month	BST Avg.	CLEC Avg.	Difference
July	1004.103	994.9774	9.1256
August	1166.9031	847.2192	319.6839
September	1058.8630	956.0904	102.7726

ATLAS

Month	BST Avg.	CLEC Avg.	Difference
July	846.6394	703.1209	143.5185
August	781.1923	575.5153	205.6770
September	825.6310	641.7002	183.9308

DSAP

Month	BST Avg.	CLEC Avg.	Difference
July	554.2276	329.2773	224.9503
August	935.0707	469.7801	465.2906
September	588.7813	414.0856	174.6957

RSAG(By ADDR)

Month	BST Avg.	CLEC Avg.	Difference
July	1523.8004	1219.4003	304.4001
August	1665.1581	1016.0048	649.1533
September	1705.3642	1179.6597	525.7045

RSAG(By TN)

Month	BST Avg.	CLEC Avg.	Difference
July	1155.2793	1313.2923	-158.0130
August	1158.4645	999.9169	158.5476
September	1138.1552	1204.2639	-66.1087

It is of note that of the fifteen differences calculated, only two displayed negative differences, signaling even the possibility of any potential discrimination against the CLECs.

Time Series Analysis

Concerned with the possibility of a time dependence within the data, we employed time series analysis methodology. Figure 1 illustrates the average response interval differences for the four systems with "like-to-like" data. Figure 2 displays the average response interval differences for the overall series as a whole and also broken down by month.

A brief look at the graphs and the individual differences for each of the five series pointed out that the vast majority of days displayed positive differences. In fact, with only one exception, each day that exhibited a negative average response interval difference was always followed by a day with a positive difference. It was hard to judge from a preliminary study of the data and graphs if a time component was present, so we decided to engage in a more serious time series analysis.

The existence of unequal sample sizes for each day led us to reject the assumption that constant standard error between days existed and thus we had to conclude that the differences are not identically distributed. If we could estimate the daily variances, s_{1i}^2 and s_{2i}^2 , we would correct this problem by standardizing each difference by dividing by an estimate of the standard error as in (1).

$$\frac{d_i}{\sqrt{s_p^2\left(\frac{1}{n_{1i}}+\frac{1}{n_{2i}}\right)}} \qquad (1)$$

Here s_p^2 is the pooled variance estimate, n_{1i} is the total number of BellSouth calls for the i^{th} date and n_{2i} is the total number of CLEC calls for the i^{th} date. Lacking this, we did the next best thing. We assumed that the variance for each response every day was constant, but unknown. Dividing each difference, d_i, by

$$\sqrt{\frac{1}{n_{1i}}+\frac{1}{n_{2i}}}$$

provides a rescaling that is proportional to the typical standardized value.

After rescaling the data, we dealt with the issue of missing observations. For a few dates within our time frame of interest, the CLECs data were present while BellSouth data were not. To correct this problem, we imputed on those days the mean values from the series. Using this method, we have a tendency to underestimate the standard error. An alternative may be to employ the EM algorithm to impute these values. However, we did not use the EM algorithm, because we felt our method was more conservative.

The autocorrelation and partial autocorrelation functions for each series were plotted using Interactive Time Series Modeling 6.0 (ITSM) software in an attempt to identify the existence of a time dependent process. Table 2 illustrates the results of our time series analysis and the associated parameters.

Table 2 - Time Series Analysis Results

System	Result	Parameters	Estimated White Noise Variance
ATLAS	white noise	-	87193260
DSAP	AR(3) model	ϕ_1=.060325 ϕ_2=-.022255 ϕ_3=-.404828	445167000
RSAG(By ADDR)	AR(1) model	ϕ_1=.190761	364569000
RSAG(By TN)	white noise	-	990114000
Overall	white noise	-	269287000

Of the five models, two exhibited significant autocorrelation. The DSAP data was found to follow a third order autoregressive series. The RSAG(By ADDR) data, on the other hand appeared to follow a first order autoregressive series. The other three models (ATLAS, RSAG(By TN) and the overall series) did not exhibit significant autocorrelation and seemed to follow white noises processes.

The residuals of each series were tested under the Ljung-Box and McLeod-Li portmanteau tests of independence. These tests of independence assume independent data under the null hypothesis and are approximately chi-squared with twenty degrees of freedom. The results of these tests are provided in Table 3.

Table 3 - Tests of Independence

System	Ljung-Box test statistic	P-value (percent)	McLeod-Li test statistic	P-value (percent)
ATLAS	10.2920	96.2563	9.9157	96.9675
DSAP	11.0990	94.3615	30.2100	14.3468
RSAG(By ADDR)	22.4690	31.5613	11.6140	94.9457
RSAG(By TN)	9.9545	96.8989	2.2344	100.0000
Overall	17.6380	61.1241	13.9300	83.4027

From the results, it can be seen that the claim of independence under the null hypothesis was not rejected, and thus we believe the residuals of the differences behave as if they can be treated as independent.

For those series with an autocorrelation structure (DSAP and RSAG(By ADDR)), we conducted a generalized least squares analysis to determine the mean and standard error of each series. The generalized least squares approach takes into account the autocorrelation and produces the best linear unbiased estimate, which will result in a standard error less than or equal to the standard error of an ordinary least squares estimate. The series that did not exhibit significant autocorrelation were subjected to a ordinary least squares analysis, which amounted to a paired t-test.

For all five series, we tested under the null hypothesis that the mean of the daily differences is equal to zero, that is to say that the average response intervals are equal for both BellSouth and the CLECs. Based on the magnitude of the test statistic value and the number of observations employed in the calculation, a P-value was derived. The test results and P-values are shown in Table 4.

Table 4 - Test Results

Overall

Month	Test Statistic	df	P-value (percent)
July	0.5396	22	29.7446
August	3.7770	20	0.0592
September	1.2031	21	12.1163

ATLAS

Month	Test Statistic	df	P-value (percent)
July	3.2101	22	0.2017
August	3.2453	20	0.2027
September	3.0683	21	0.2917

DSAP

Month	Test Statistic	df	P-value (percent)
July	3.0418	22	0.2992
August	4.2157	20	0.0212
September	1.9928	21	2.9717

RSAG(By ADDR)

Month	Test Statistic	df	P-value (percent)
July	4.0417	22	0.0272
August	6.5352	20	0.0001
September	5.6244	21	0.0007

RSAG(By TN)

Month	Test Statistic	df	P-value (percent)
July	-0.8686	22	19.7226
August	1.0576	20	15.1419
September	-0.6530	21	26.0422

Of the fifteen test statistics calculated, only two had negative test values and these were quite small. Furthermore, the P-values for the two negative tests were quite large indicating that there was not enough evidence to suggest any significant differences.

References:

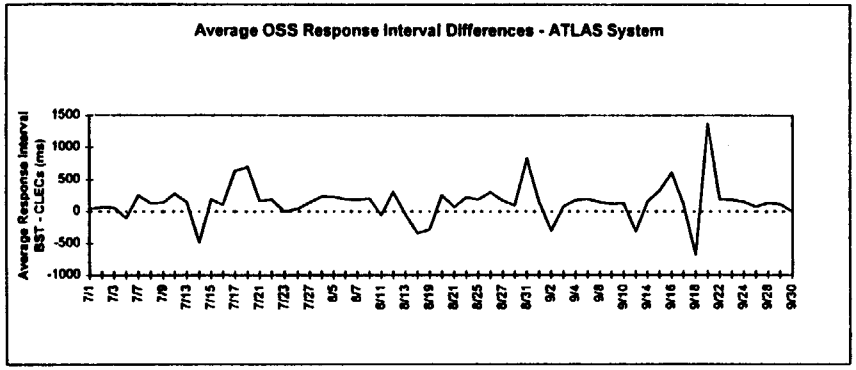
Brockwell, Peter J. and Davis, Richard A., *A First Course in Time Series Analysis*, Springer-Verlag New York, Inc., New York, 1995.

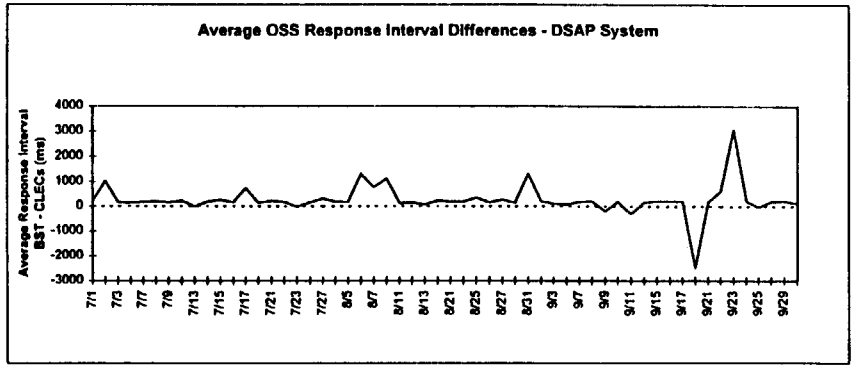
Wei, William S., *Time Series Analysis - Univariate and Multivariate Methods*, Addison-Wesley Publishing Company, Inc., Redwood City, California, 1990.

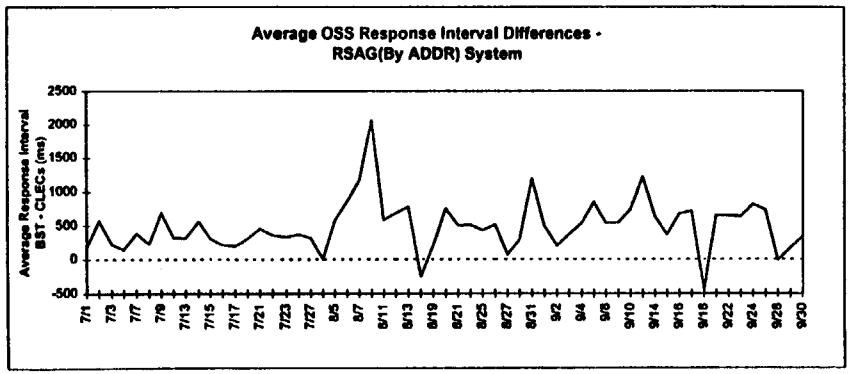
BellSouth Local Competition Operational Readiness - Prepared for the United States Department of Justice, 1997

SAS Institute Inc., *SAS/ETS® User's Guide, Version 6, Second Edition*, Cary, NC: SAS Institute Inc., 1993.

Figure 1 - Individual Time Series of Average OSS Differences - BST minus CLECs







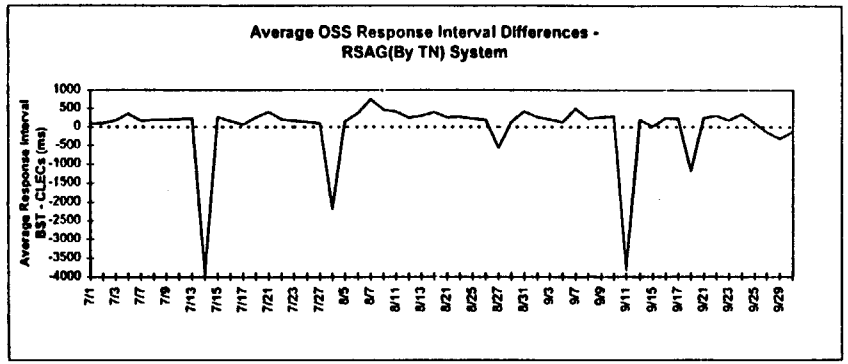
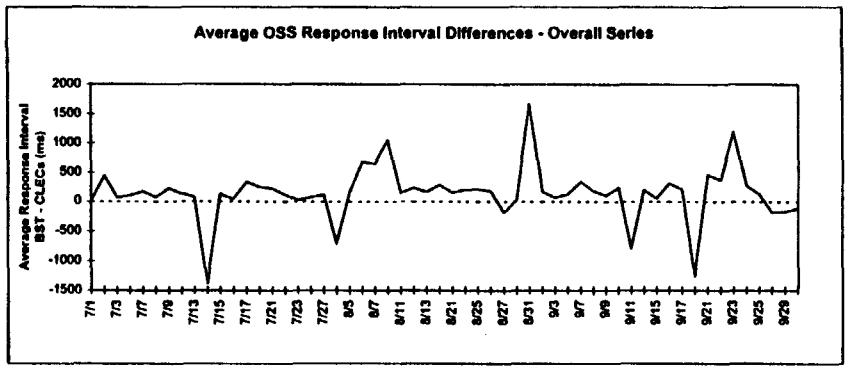
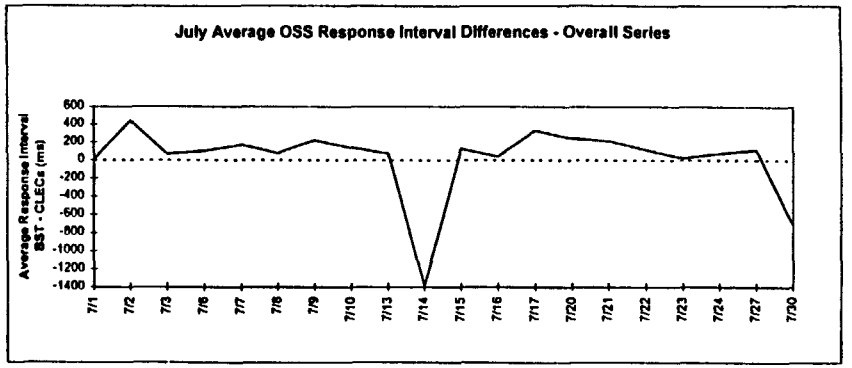
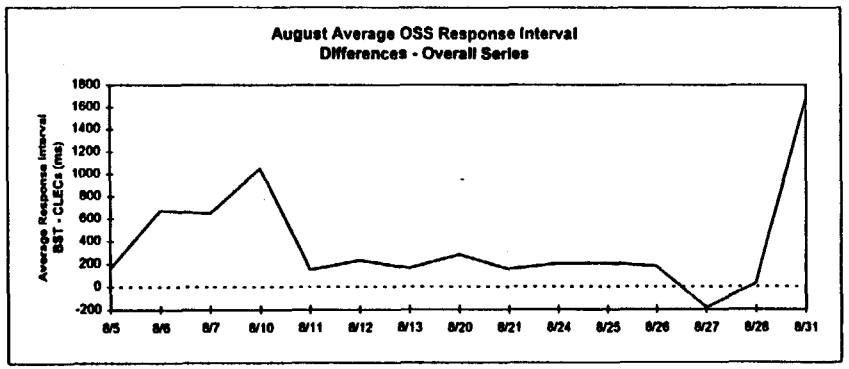
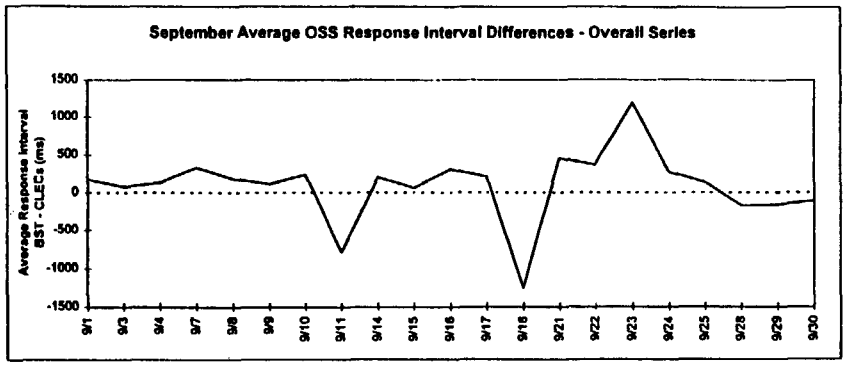


Figure 2 - Overall Time Series of Average OSS Differences - BST minus CLECs









Appendix H
LATA - August Graphics

I. Graphical Representations

OCI: Unadjusted

1. Shreveport H-1
2. Lafayette H-3
3. New Orleans H-5
4. Baton Rouge H-7

OCI: Adjusted

1. Shreveport H-2
2. Lafayette H-4
3. New Orleans H-6
4. Baton Rouge H-8

MAD: Unadjusted

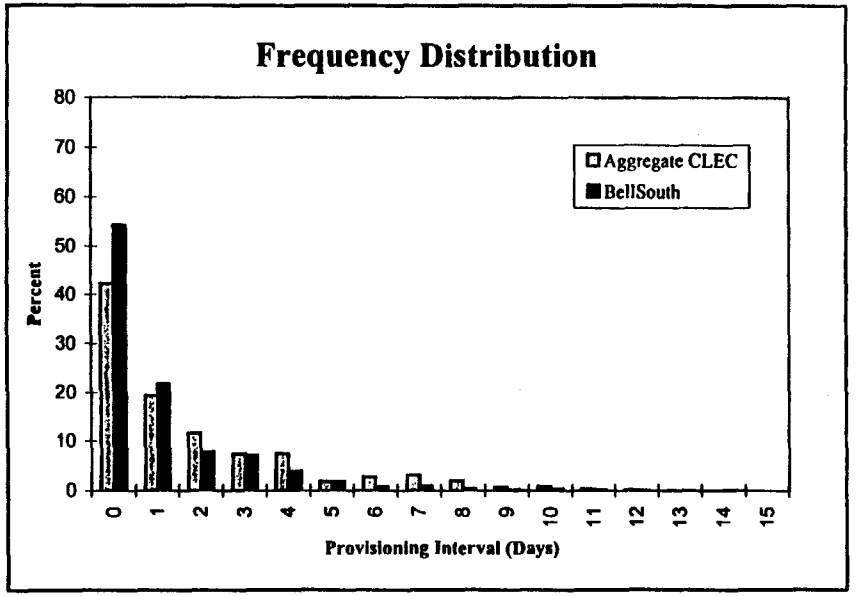
1. Shreveport H-9
2. Lafayette H-11
3. New Orleans H-13
4. Baton Rouge H-15

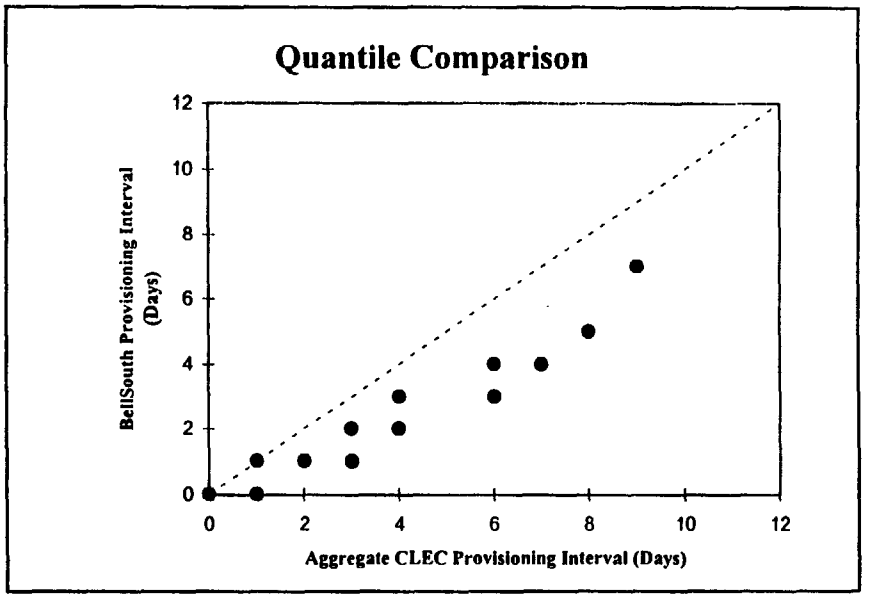
MAD: Adjusted

1. Shreveport H-10
2. Lafayette H-12
3. New Orleans H-14
4. Baton Rouge H-16

II. SQM H-17

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Shreveport Cases





Descriptive Measures

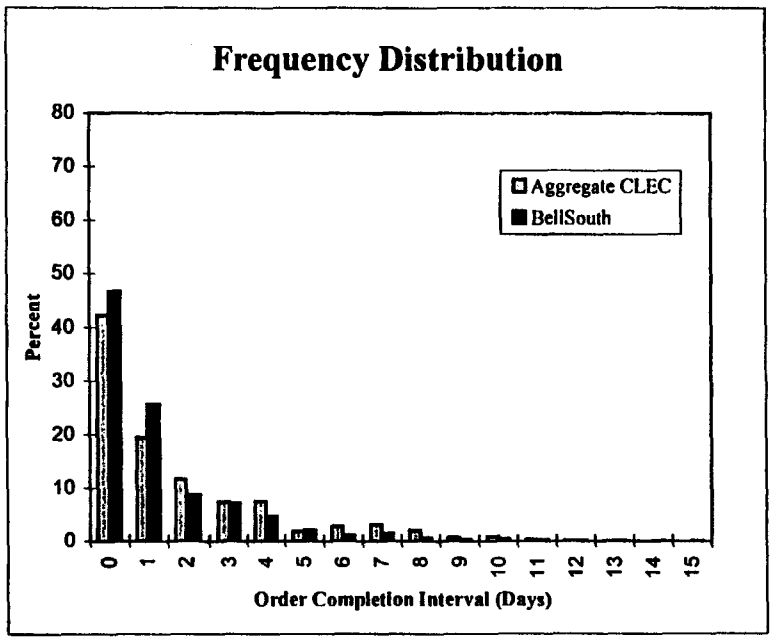
Service Provider	Mean	Standard Deviation
BST	1.16	2.34
CLEC	1.82	2.54
Difference	-0.67	

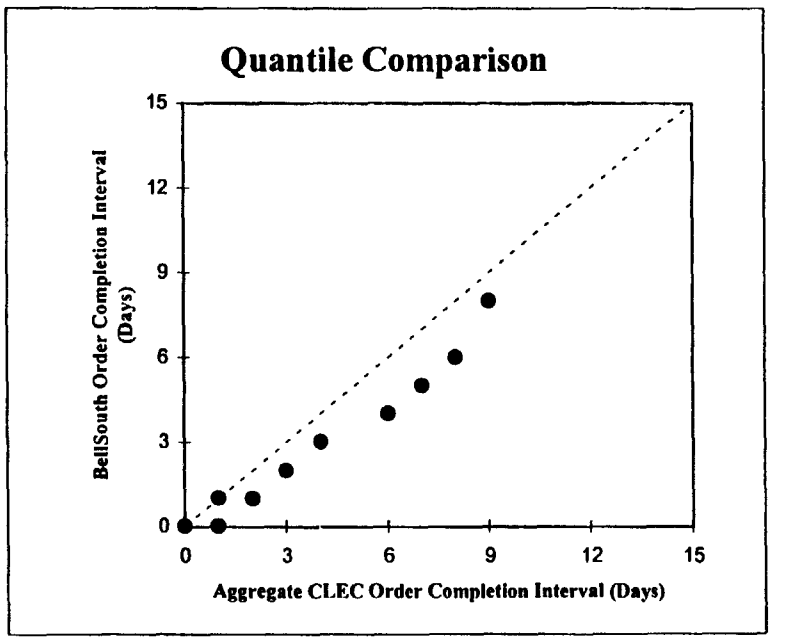
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-19.87	0.0000
FCC	-19.78	0.0000
BST	-5.43	0.0004

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Shreveport Cases





Descriptive Measures

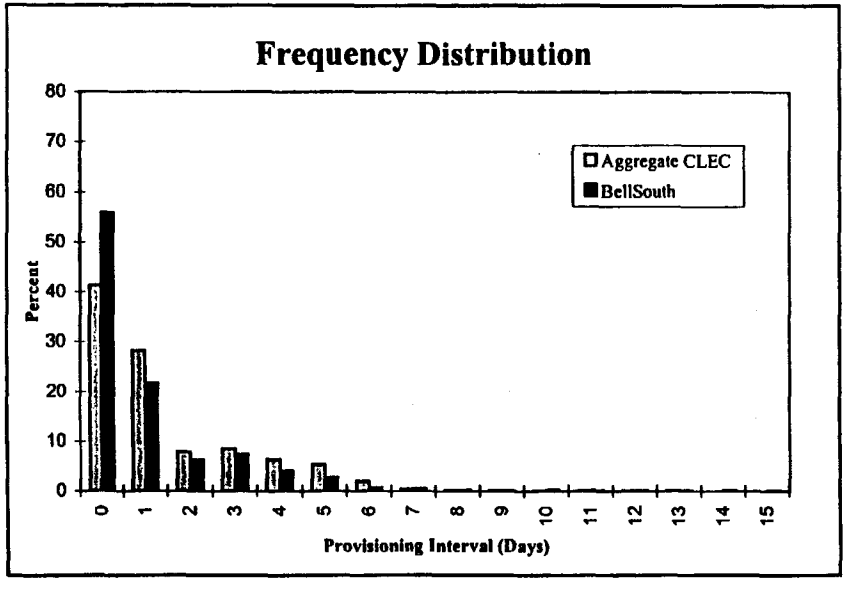
Service Provider	Mean	Standard Deviation
BST	1.41	2.54
CLEC	1.82	2.54
Difference	-0.42	

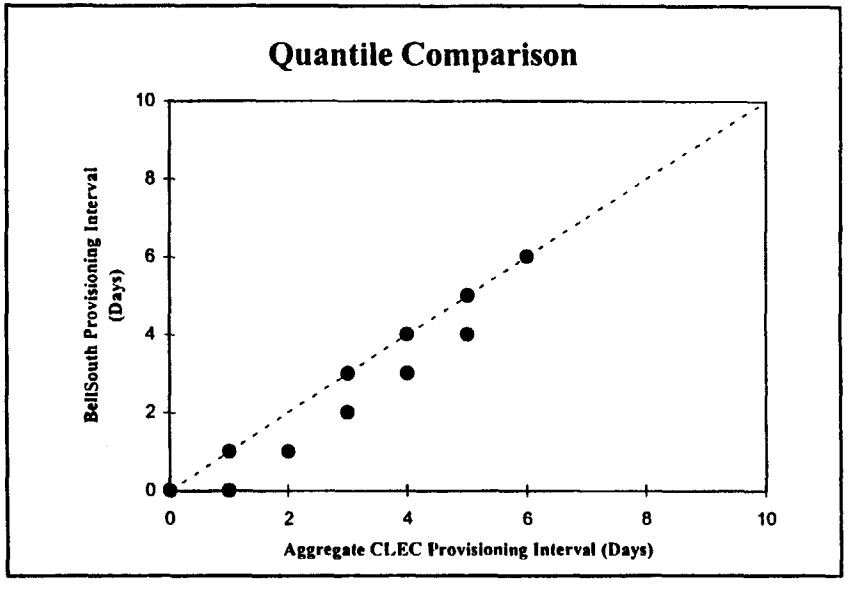
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-11.44	0.0000
FCC	-11.44	0.0000
BST	-4.54	0.0046

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Lafayette Cases





Descriptive Measures

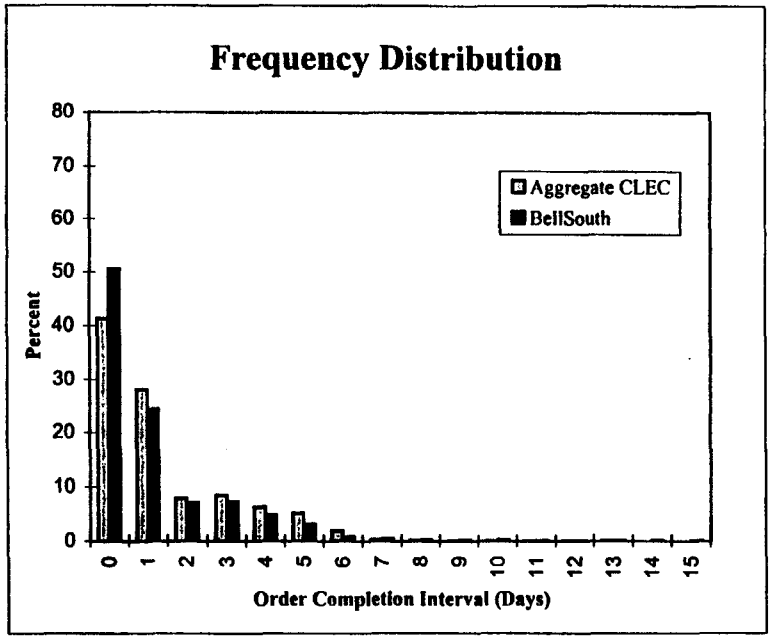
Service Provider	Mean	Standard Deviation
BST	1.11	2.31
CLEC	1.38	1.71
Difference	-0.27	

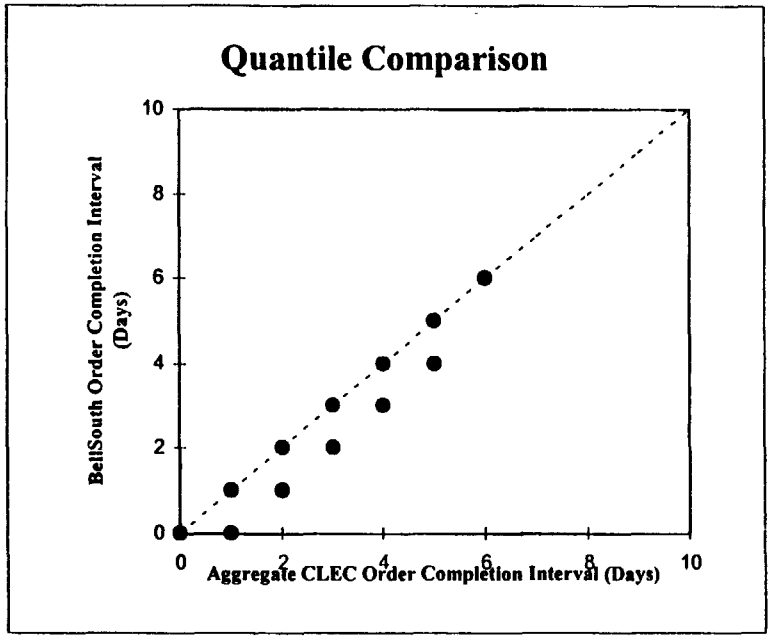
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-6.26	0.0000
FCC	-6.32	0.0000
BST	-2.53	0.8676

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Lafayette Cases





Descriptive Measures

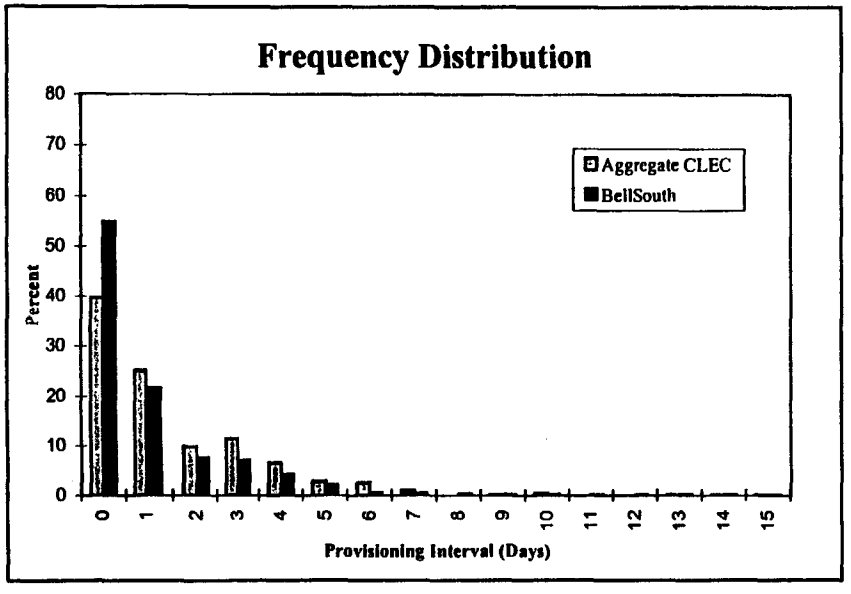
Service Provider	Mean	Standard Deviation
BST	1.21	2.24
CLEC	1.38	1.71
Difference	-0.17	

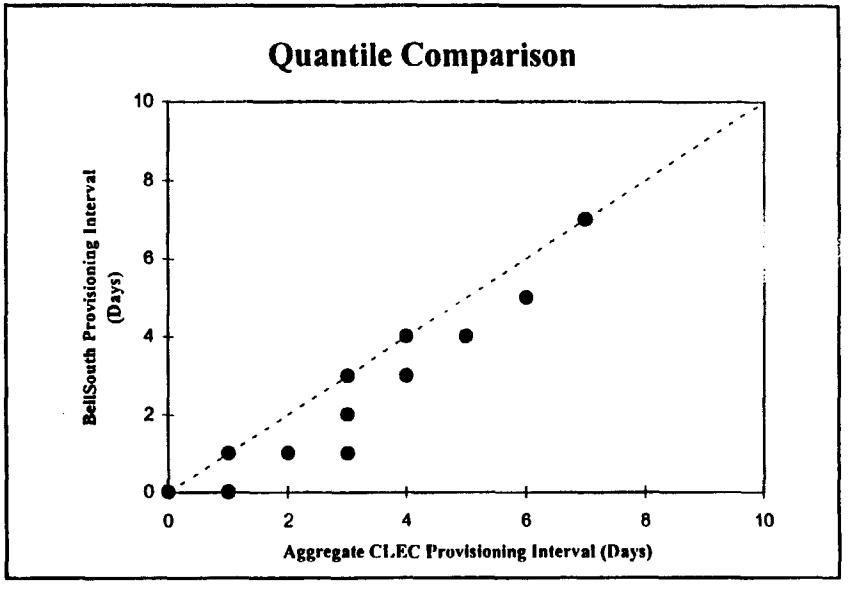
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-3.99	0.0033
FCC	-4.03	0.0028
BST	-1.62	5.7944

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
New Orleans Cases





Descriptive Measures

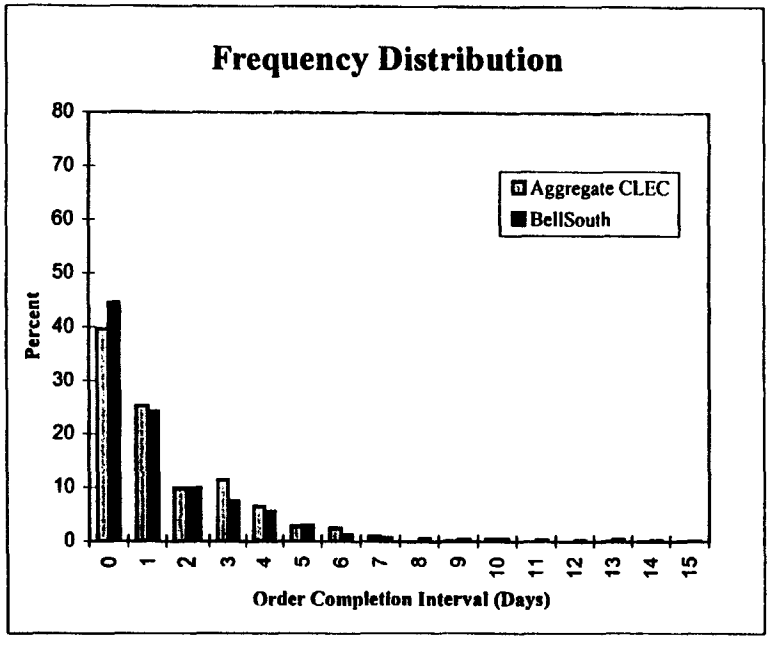
Service Provider	Mean	Standard Deviation
BST	1.21	2.90
CLEC	1.57	2.25
Difference	-0.37	

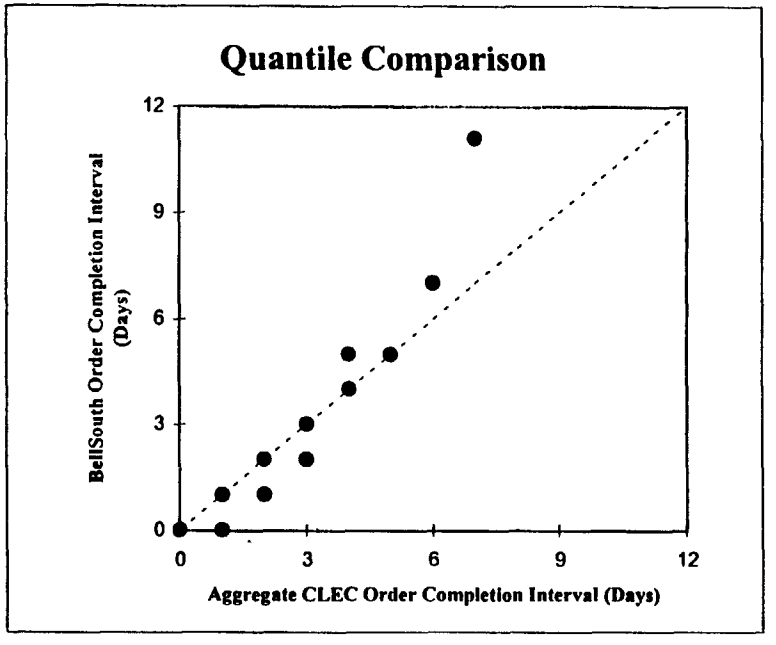
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-9.09	0.0000
FCC	-9.15	0.0000
BST	-5.17	0.0008

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
New Orleans Cases





Descriptive Measures

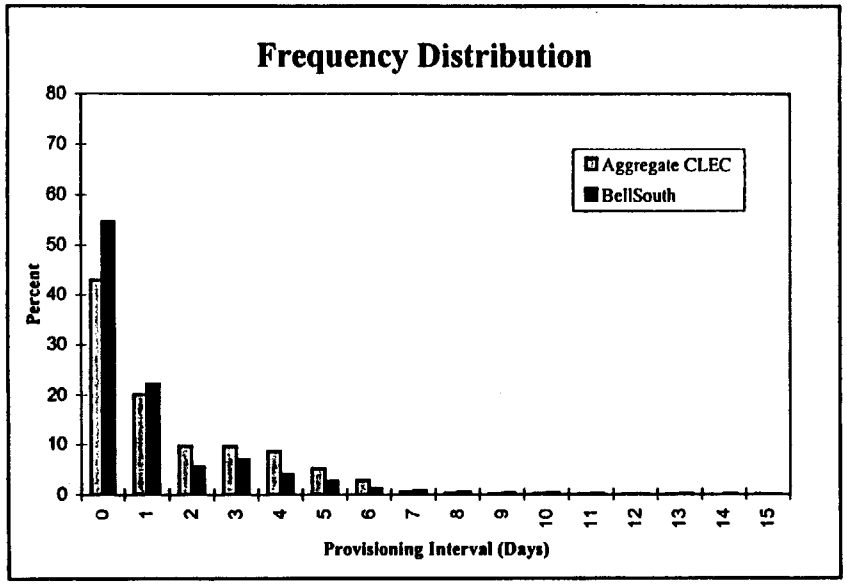
Service Provider	Mean	Standard Deviation
BST	1.70	3.53
CLEC	1.57	2.25
Difference	0.12	

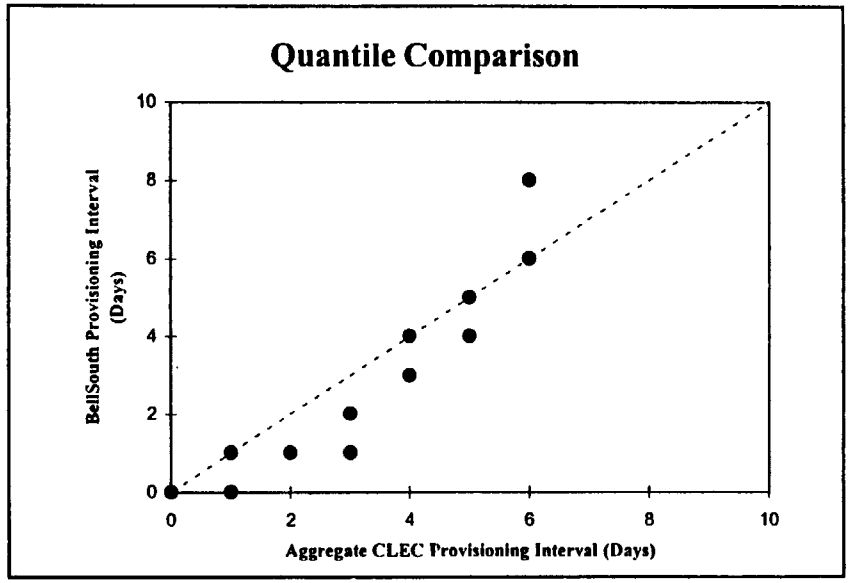
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.55	0.5418
FCC	2.57	0.5065
BST	1.93	3.1819

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Completion Interval-Provisioning
Baton Rouge Cases





Descriptive Measures

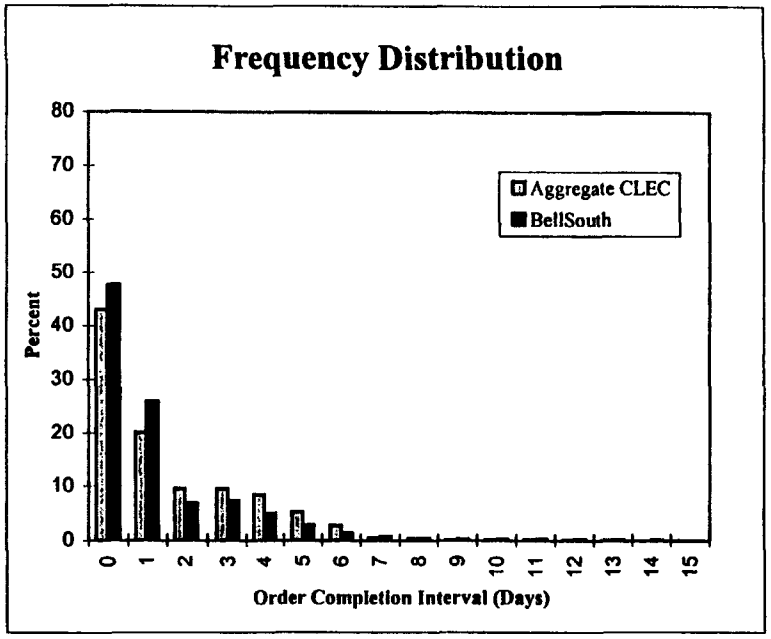
Service Provider	Mean	Standard Deviation
BST	1.35	3.41
CLEC	1.58	2.19
Difference	-0.24	

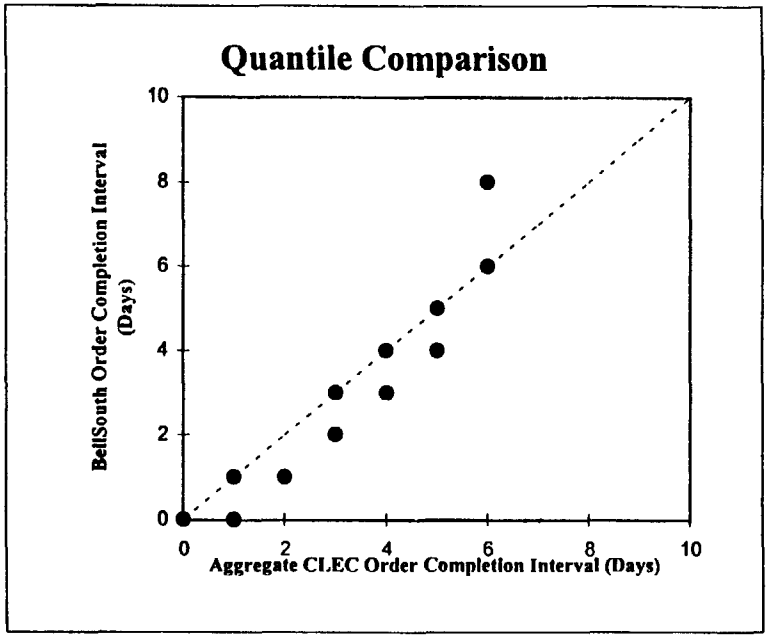
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-3.45	0.0283
FCC	-3.49	0.0245
BST	-1.50	7.3067

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
August BellSouth and CLEC Completion Interval-Provisioning
Baton Rouge Cases





Descriptive Measures

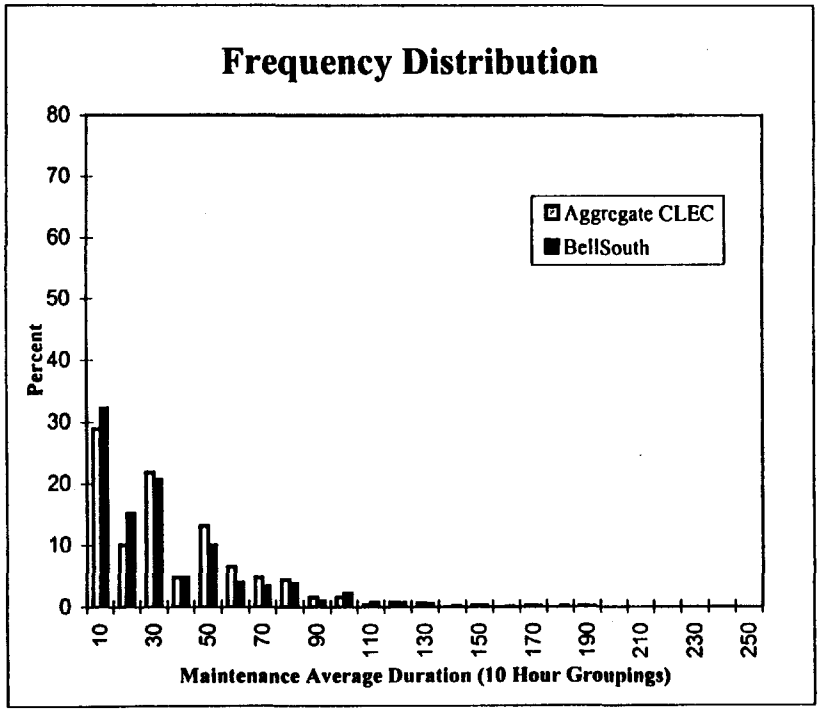
Service Provider	Mean	Standard Deviation
BST	1.44	3.00
CLEC	1.58	2.19
Difference	-0.14	

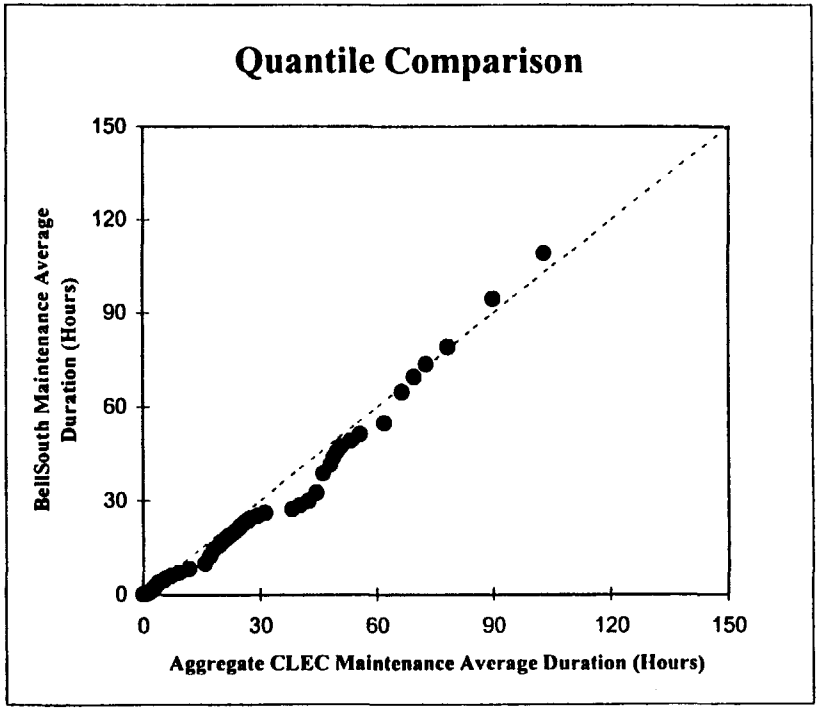
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-2.33	0.9806
FCC	-2.35	0.9268
BST	-0.78	22.0778

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Shreveport





Descriptive Measures

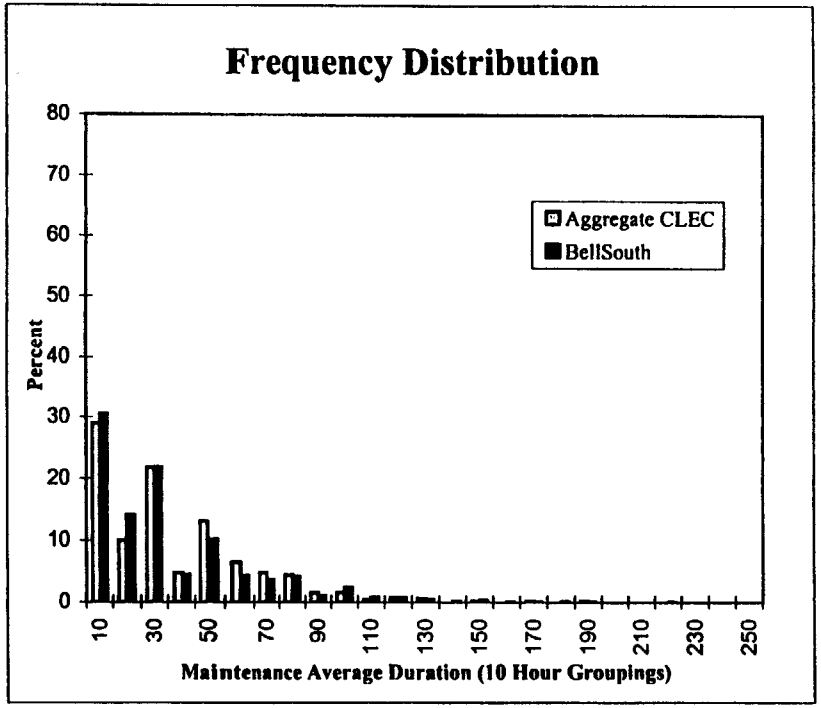
Service Provider	Mean	Standard Deviation
BST	28.16	28.59
CLEC	31.48	28.47
Difference	-3.32	

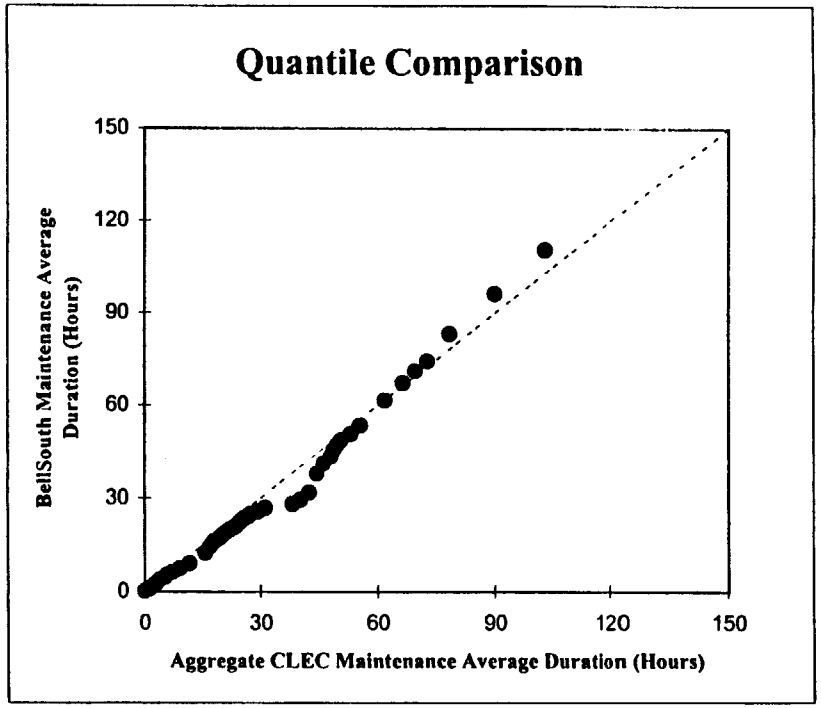
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-2.61	0.4546
FCC	-2.61	0.4542
BST	-1.73	4.7365

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Shreveport





Descriptive Measures

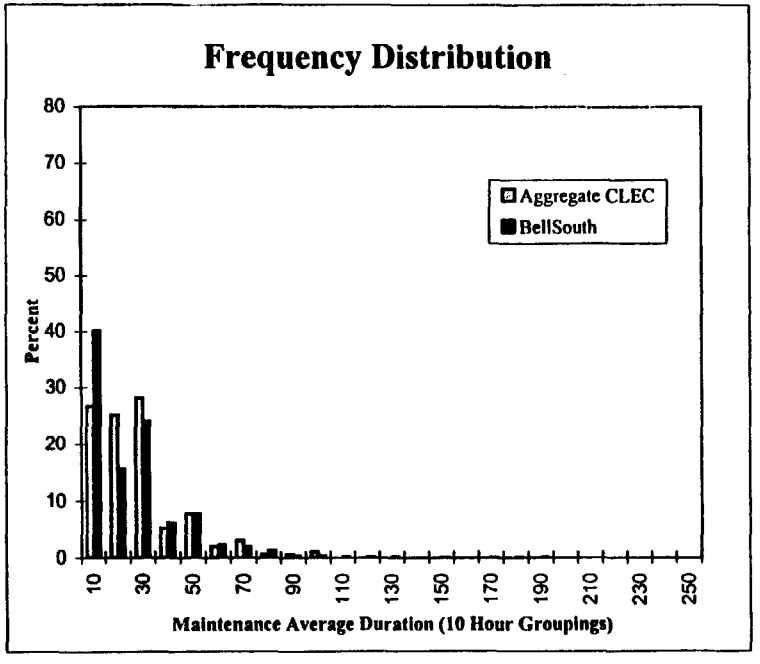
Service Provider	Mean	Standard Deviation
BST	29.48	29.34
CLEC	31.48	28.47
Difference	-2.00	

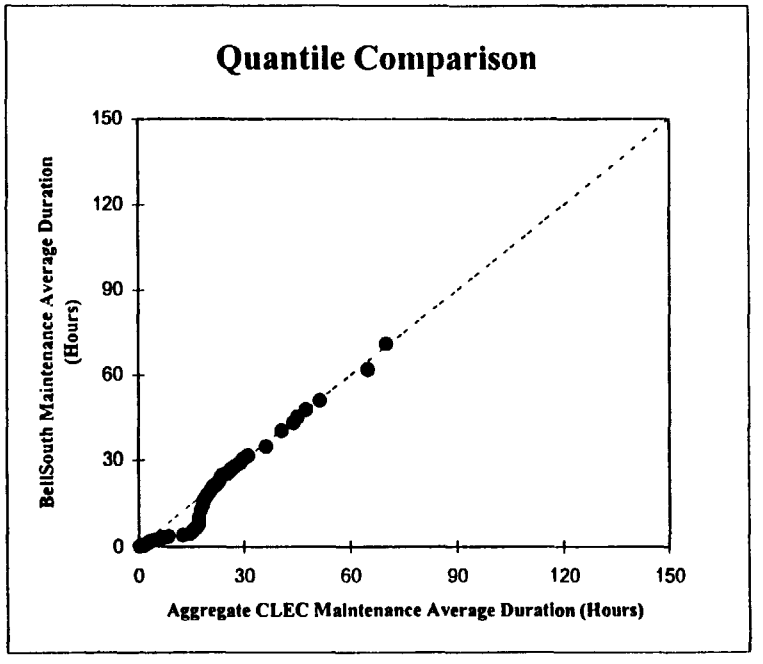
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.53	6.3200
FCC	-1.53	6.3058
BST	-1.20	12.0398

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Lafayette





Descriptive Measures

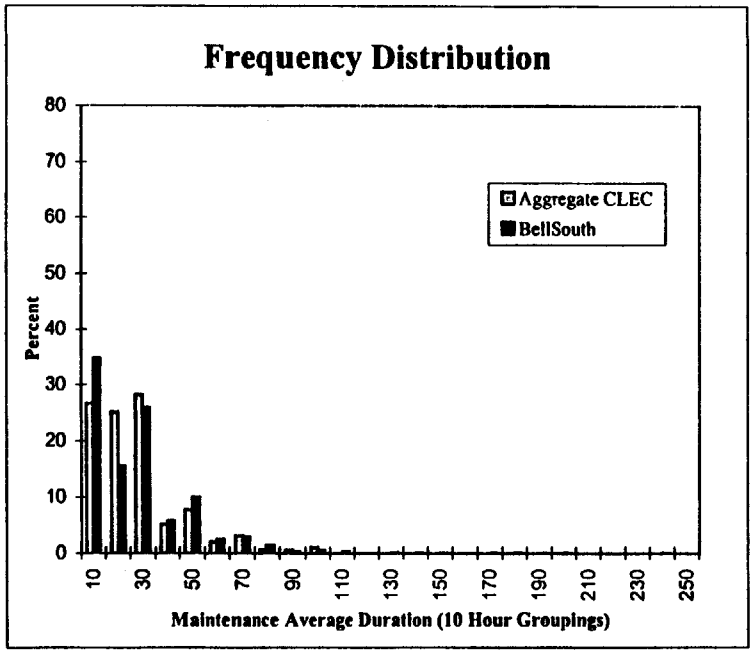
Service Provider	Mean	Standard Deviation
BST	19.66	19.95
CLEC	21.93	17.99
Difference	-2.27	

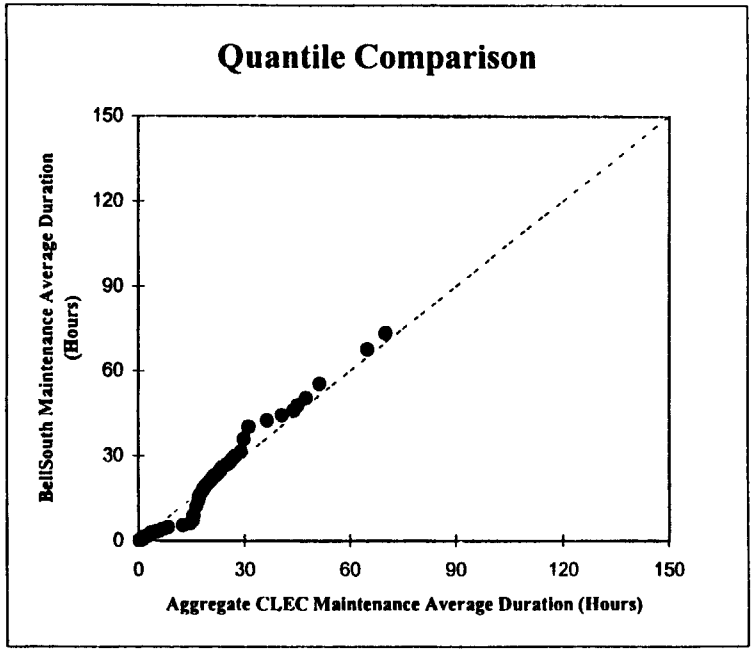
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.57	5.7690
FCC	-1.58	5.7438
BST	-1.92	3.3402

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Lafayette





Descriptive Measures

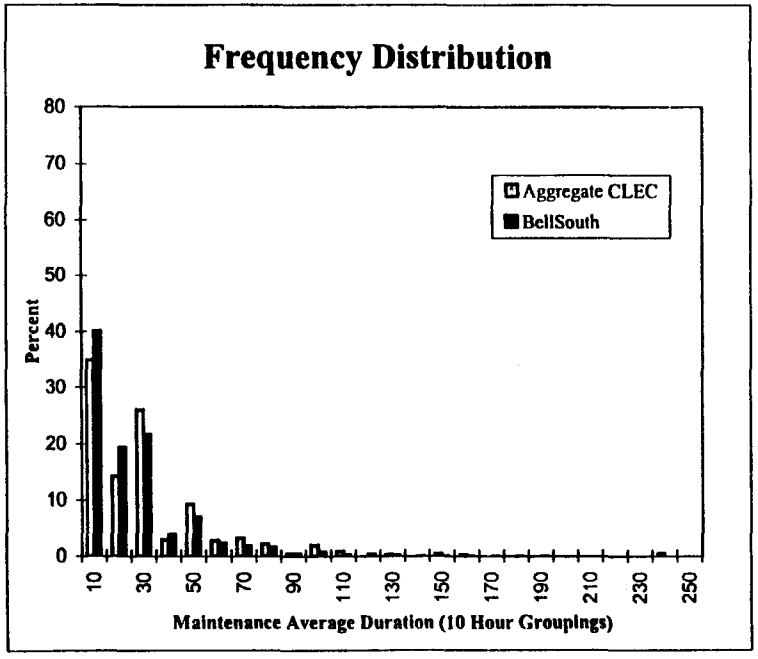
Service Provider	Mean	Standard Deviation
BST	22.21	21.24
CLEC	21.93	17.99
Difference	0.28	

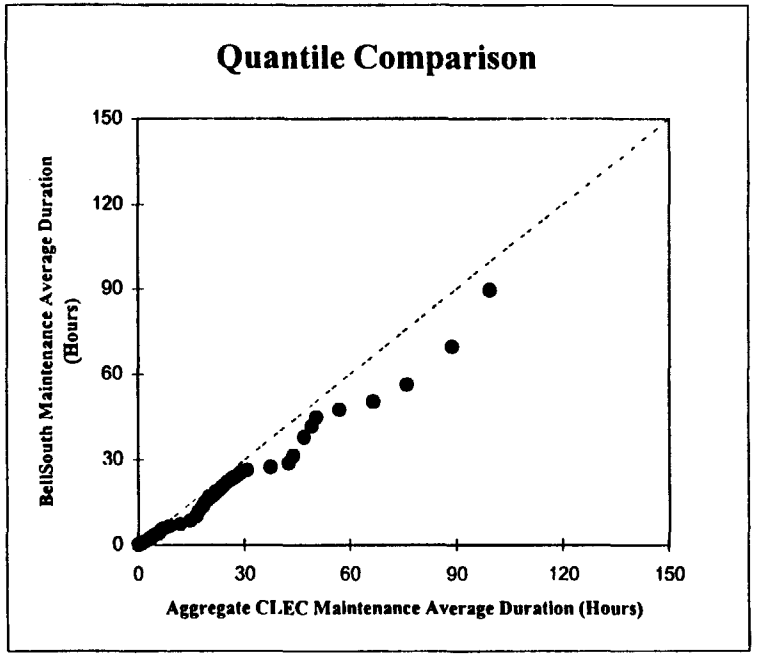
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.18	42.7508
FCC	0.18	42.7358
BST	0.16	43.8402

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
New Orleans





Descriptive Measures

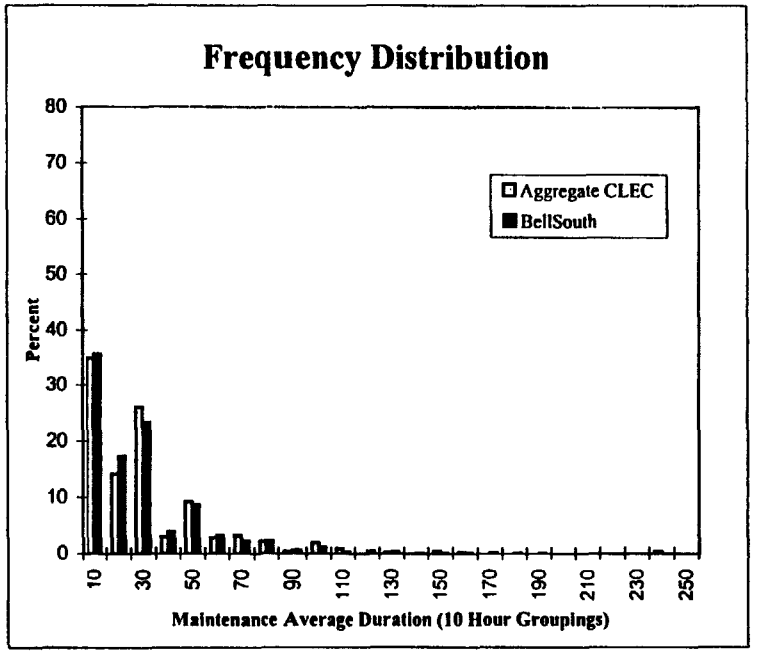
Service Provider	Mean	Standard Deviation
BST	20.24	22.72
CLEC	25.55	28.81
Difference	-5.31	

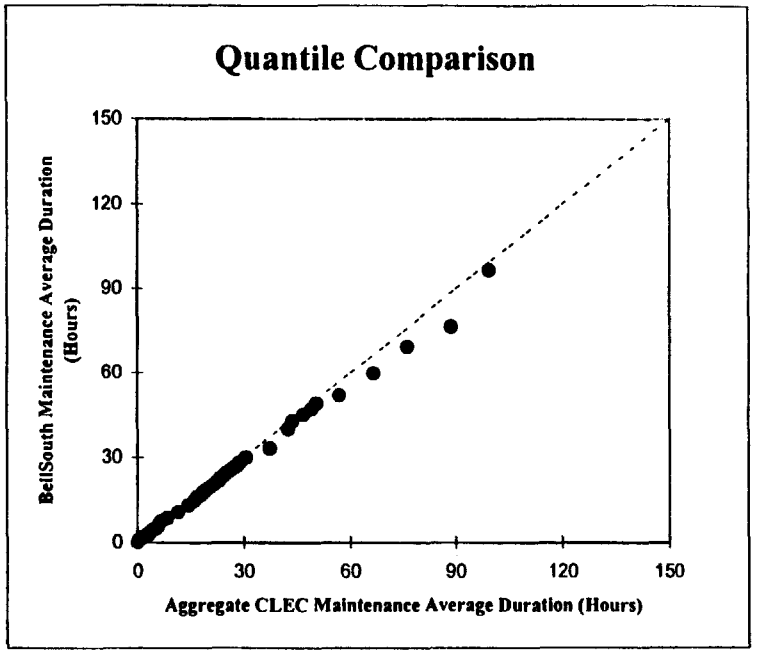
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-5.00	0.0000
FCC	-4.97	0.0000
BST	-3.32	0.1233

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
New Orleans





Descriptive Measures

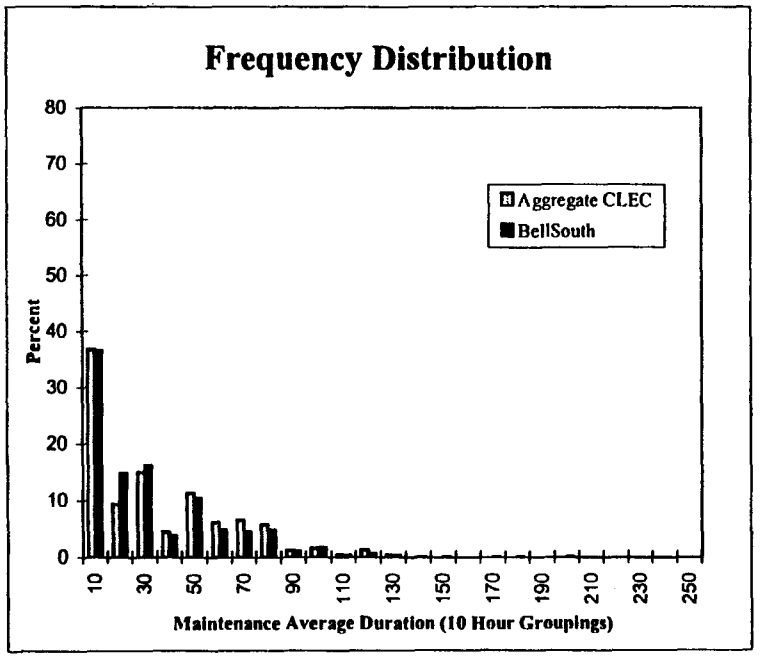
Service Provider	Mean	Standard Deviation
BST	23.58	25.06
CLEC	25.55	28.81
Difference	-1.97	

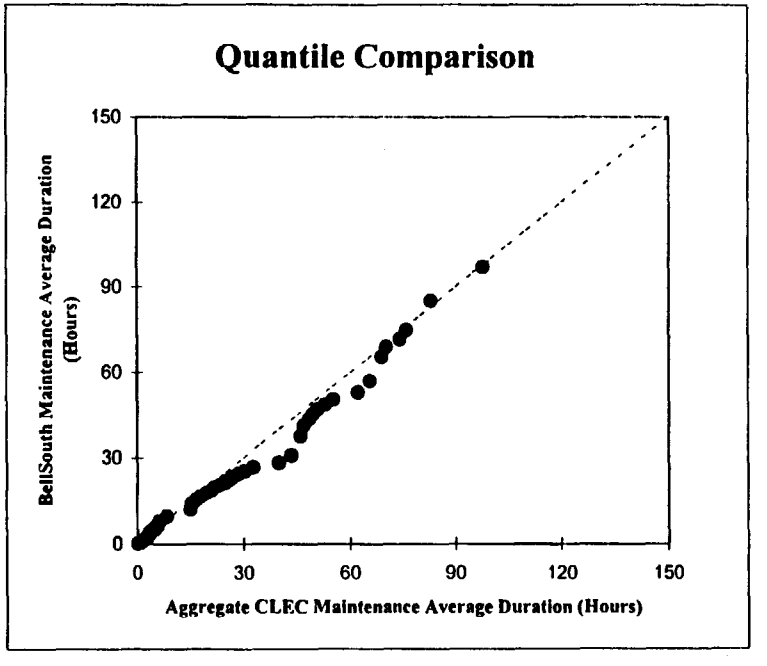
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.68	4.6442
FCC	-1.68	4.6897
BST	-1.57	6.4115

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
August BellSouth and CLEC Average Duration-Maintenance
Baton Rouge





Descriptive Measures

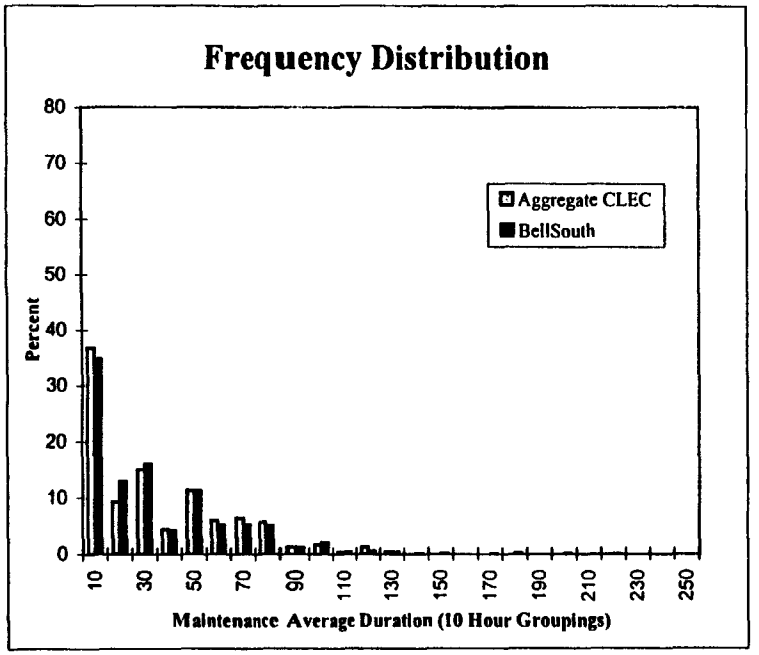
Service Provider	Mean	Standard Deviation
BST	27.02	27.53
CLEC	29.76	28.20
Difference	-2.74	

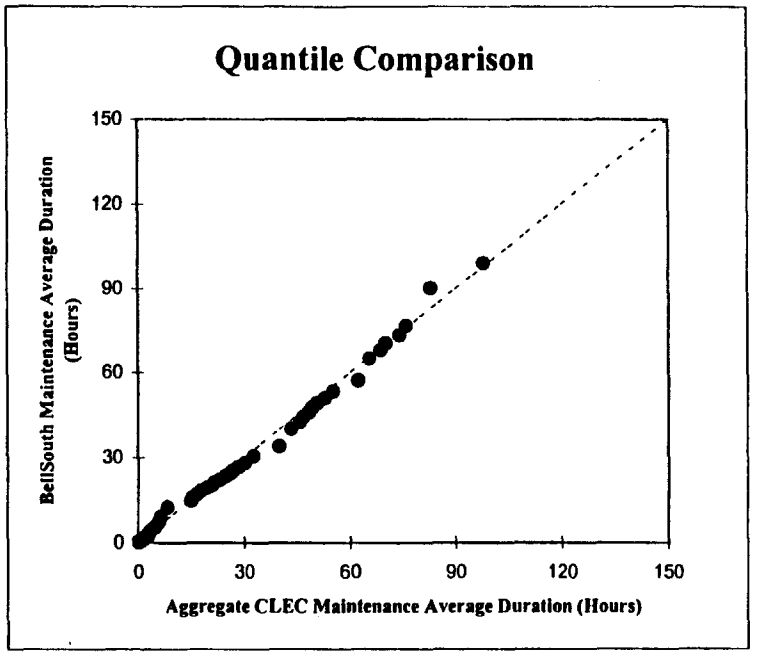
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.55	6.1050
FCC	-1.55	6.1143
BST	-0.96	17.5778

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
August BellSouth and CLEC Average Duration-Maintenance
Baton Rouge





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	29.25	28.98
CLEC	29.76	28.20
Difference	-0.51	

Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-0.27	39.2847
FCC	-0.27	39.2790
BST	-0.24	40.8240

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Appendix I
LATA - September Graphics

I. Graphical Representations

OCI: Unadjusted

1. Shreveport I-1
2. Lafayette I-3
3. New Orleans I-5
4. Baton Rouge I-7

OCI: Adjusted

1. Shreveport I-2
2. Lafayette I-4
3. New Orleans I-6
4. Baton Rouge I-8

MAD: Unadjusted

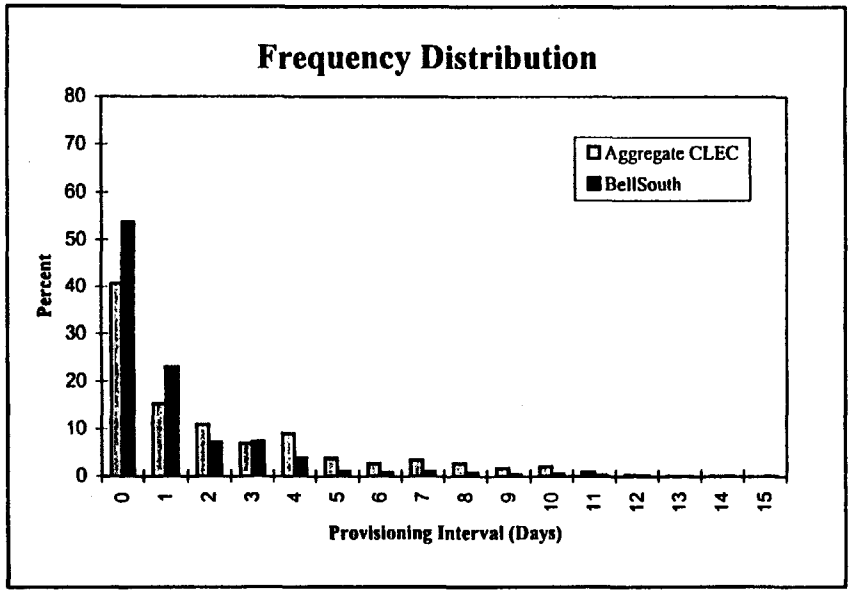
1. Shreveport I-9
2. Lafayette I-11
3. New Orleans I-13
4. Baton Rouge I-15

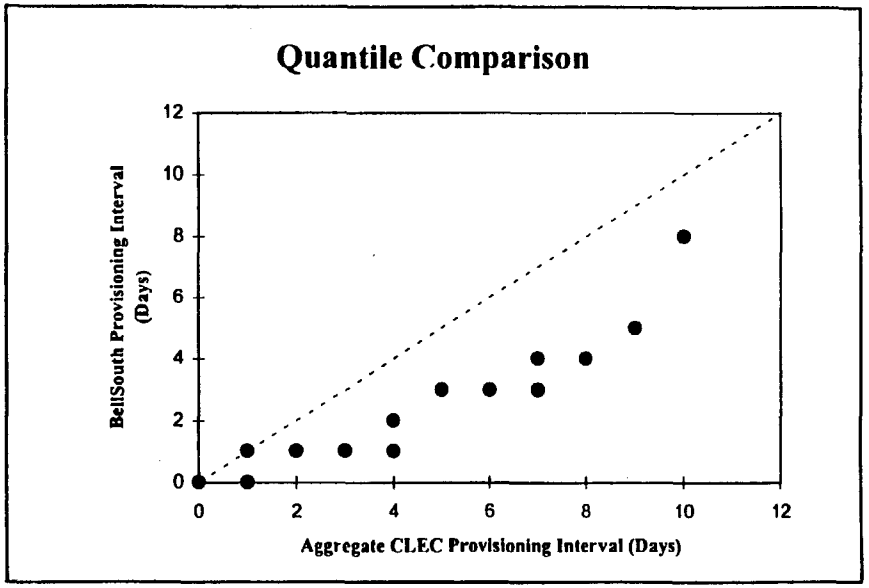
MAD: Adjusted

1. Shreveport I-10
2. Lafayette I-12
3. New Orleans I-14
4. Baton Rouge I-16

II. SQM I-17

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Shreveport Cases





Descriptive Measures

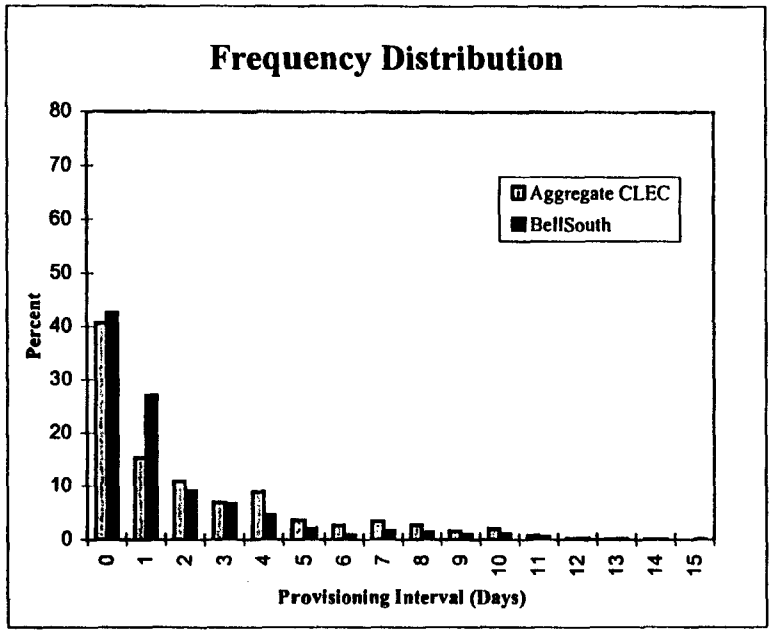
Service Provider	Mean	Standard Deviation
BellSouth	1.19	2.49
CLEC Aggregate	2.23	2.88
Difference	-1.04	

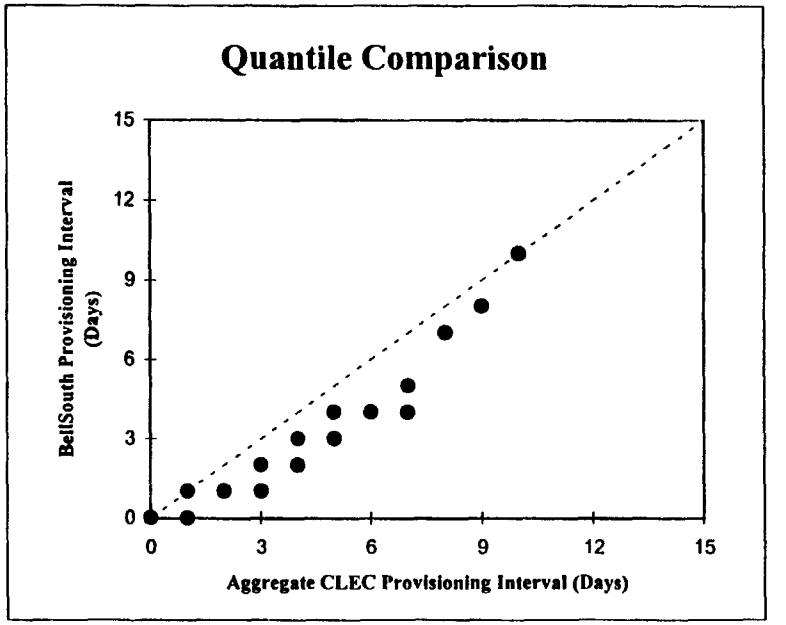
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-29.65	0.0000
FCC	-29.38	0.0000
BST	-6.93	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Shreveport Cases





Descriptive Measures

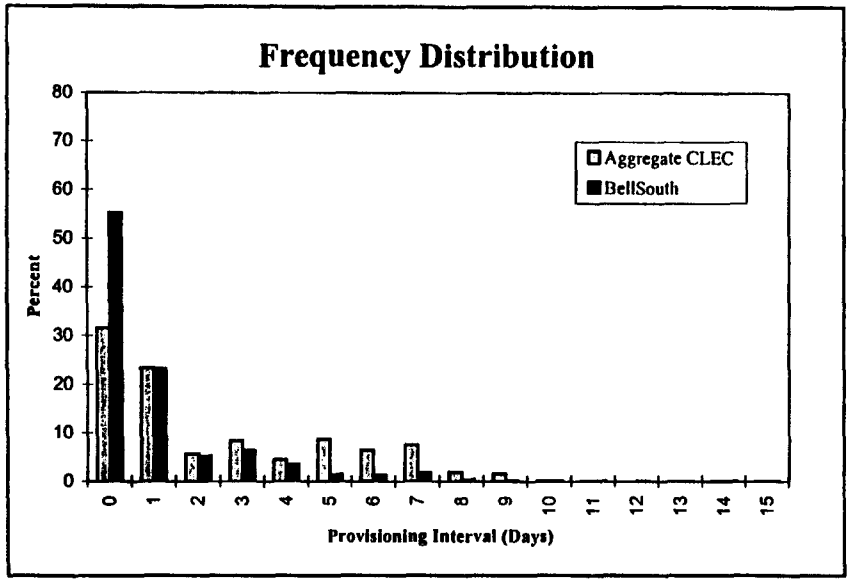
Service Provider	Mean	Standard Deviation
BST	1.70	3.00
CLEC	2.23	2.88
Difference	-0.53	

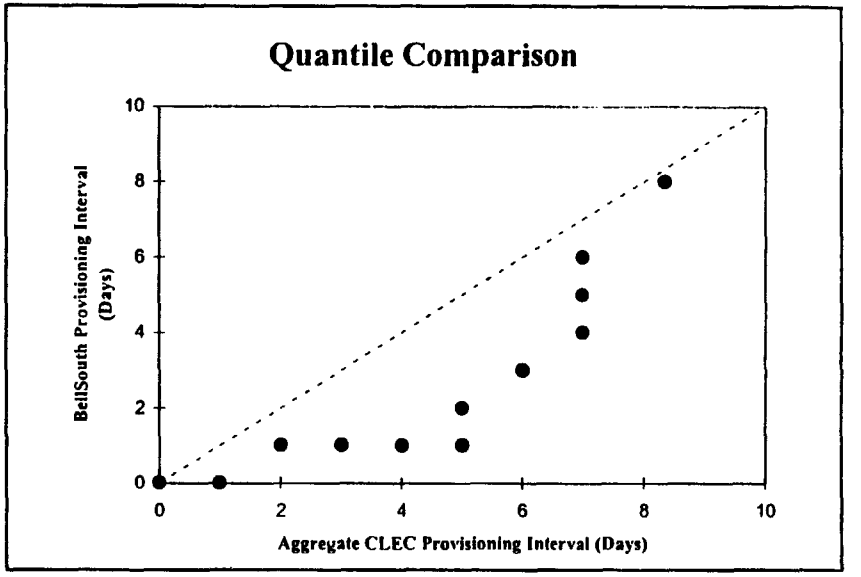
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-12.53	0.0000
FCC	-12.56	0.0000
BST	-4.18	0.0121

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Lafayette Cases





Descriptive Measures

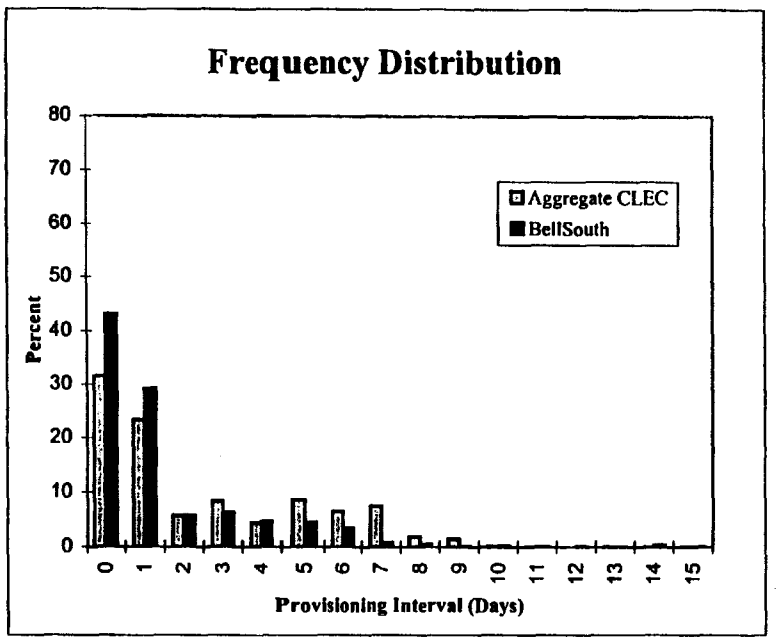
Service Provider	Mean	Standard Deviation
BellSouth	1.27	2.97
CLEC Aggregate	2.48	2.73
Difference	-1.22	

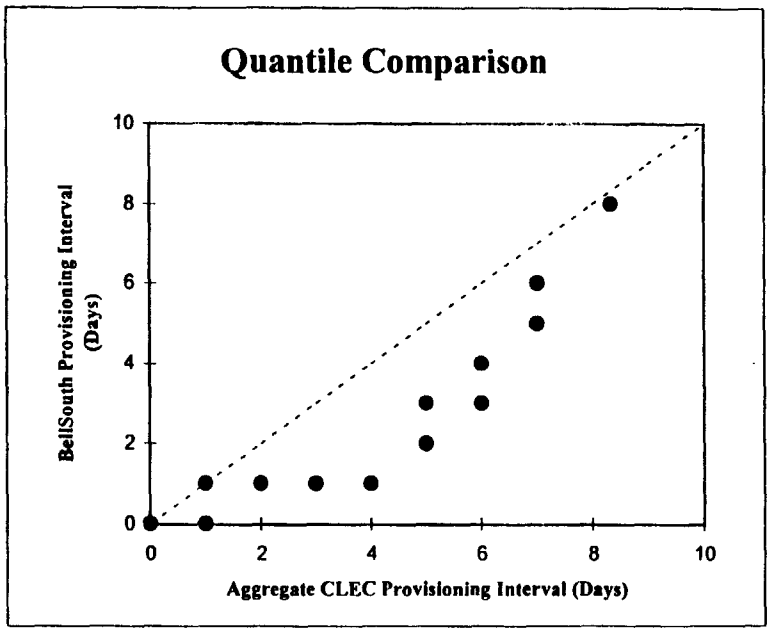
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-20.18	0.0000
FCC	-20.24	0.0000
BST	-8.82	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Lafayette Cases





Descriptive Measures

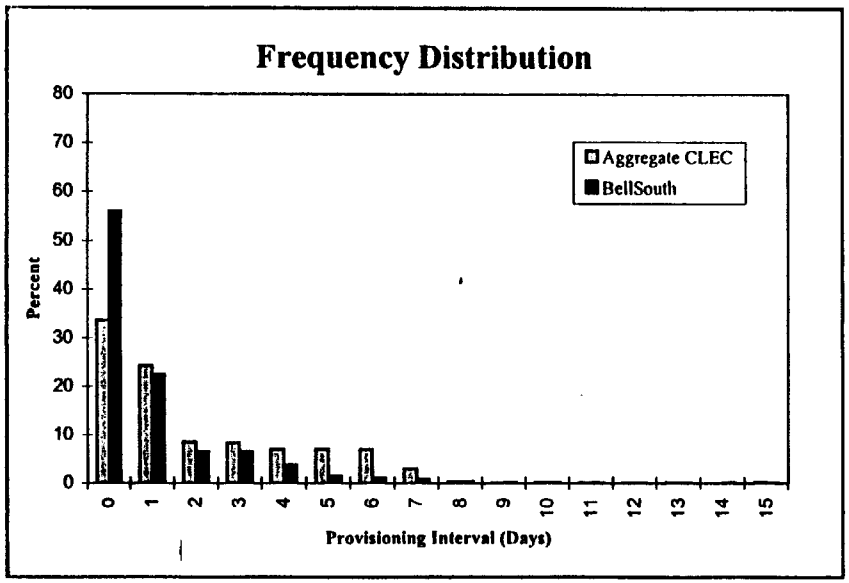
Service Provider	Mean	Standard Deviation
BST	1.56	2.59
CLEC	2.48	2.73
Difference	-0.93	

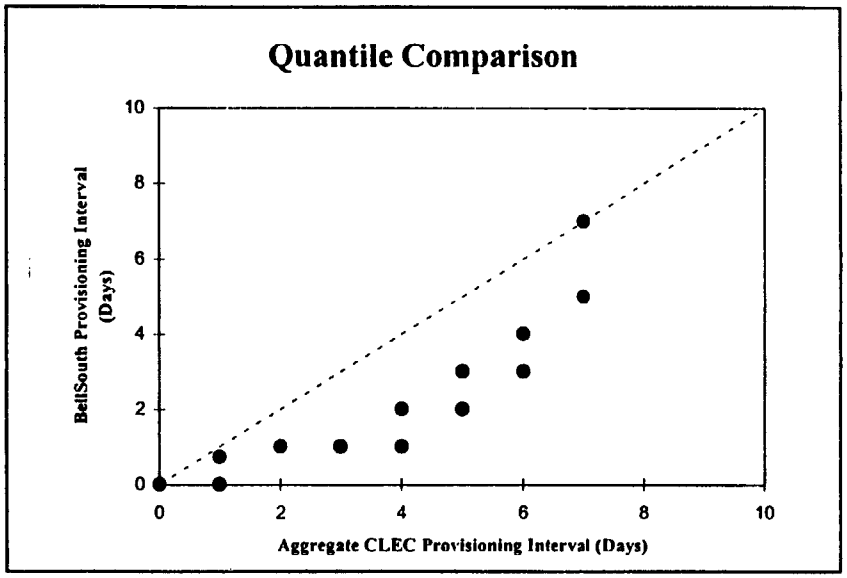
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-17.69	0.0000
FCC	-17.64	0.0000
BST	-4.69	0.0030

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
New Orleans Cases





Descriptive Measures

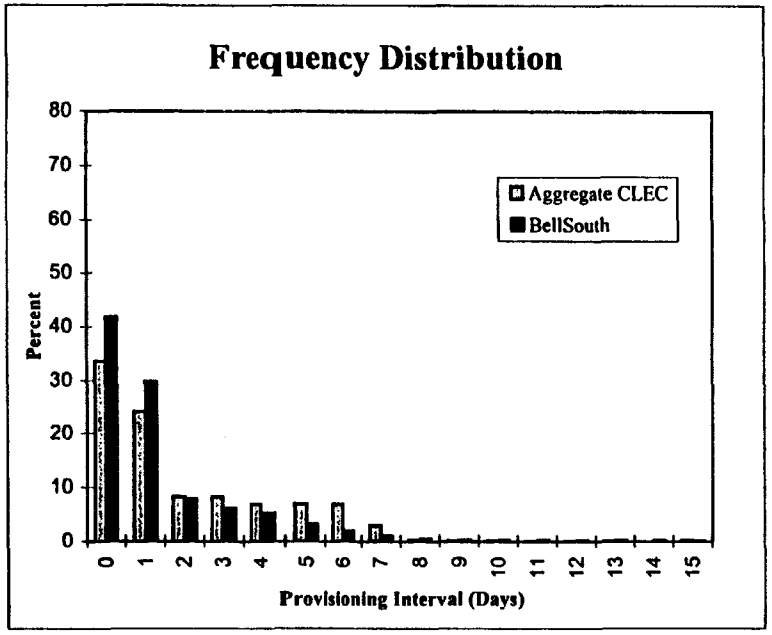
Service Provider	Mean	Standard Deviation
BellSouth	1.19	2.88
CLEC Aggregate	2.17	2.98
Difference	-0.98	

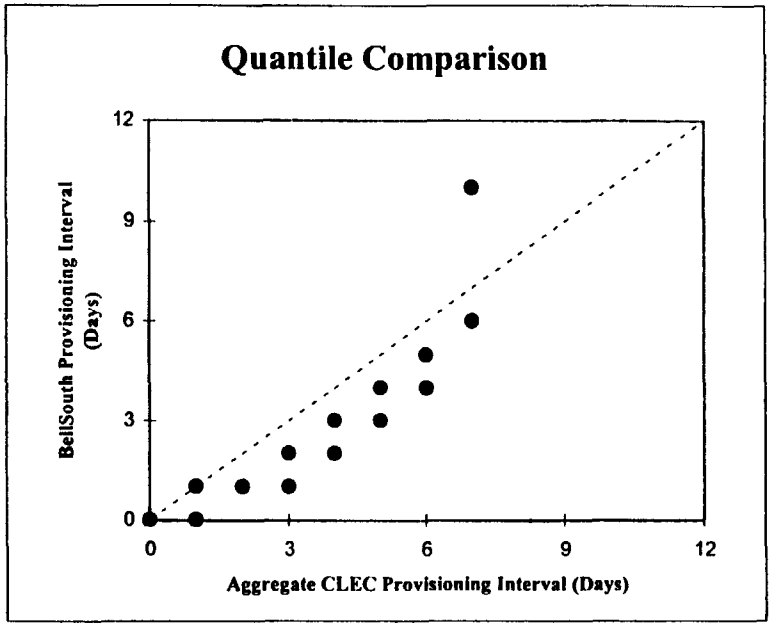
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-24.48	0.0000
FCC	-24.45	0.0000
BST	-12.18	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
New Orleans Cases





Descriptive Measures

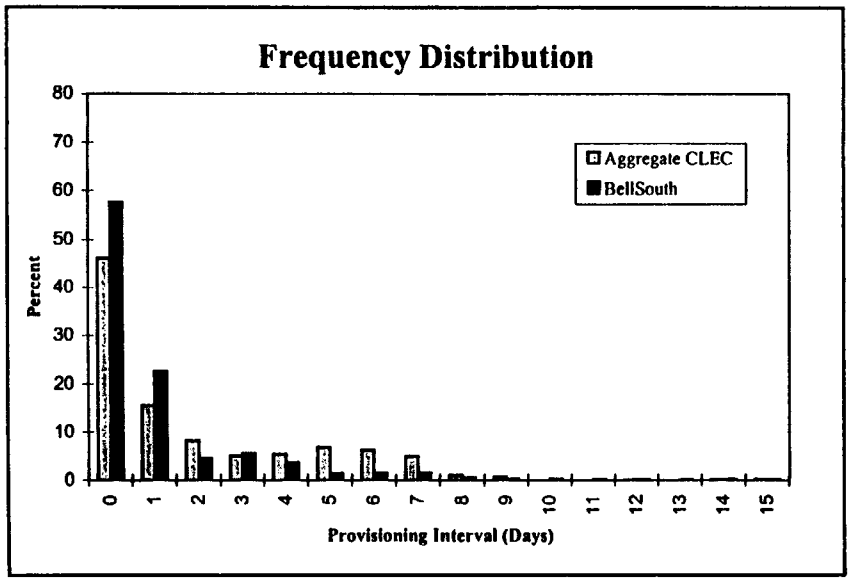
Service Provider	Mean	Standard Deviation
BST	1.64	3.30
CLEC	2.17	2.98
Difference	-0.53	

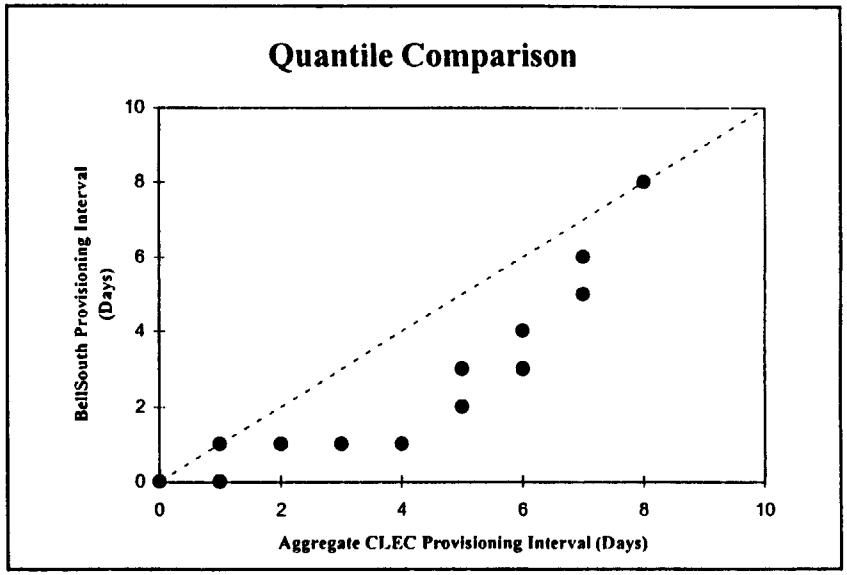
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-11.54	0.0000
FCC	-11.57	0.0000
BST	-6.59	0.0000

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Completion Interval-Provisioning
Baton Rouge Cases





Descriptive Measures

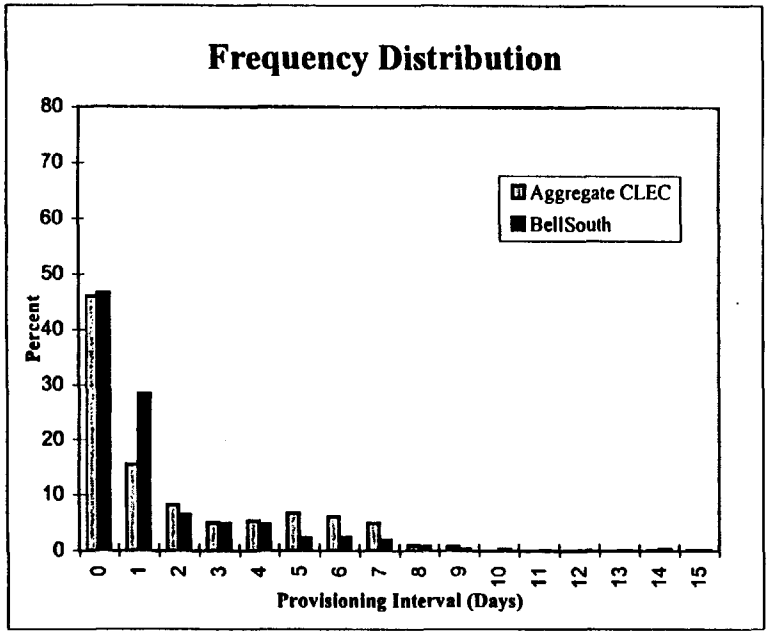
Service Provider	Mean	Standard Deviation
BellSouth	1.17	2.82
CLEC Aggregate	1.95	2.64
Difference	-0.78	

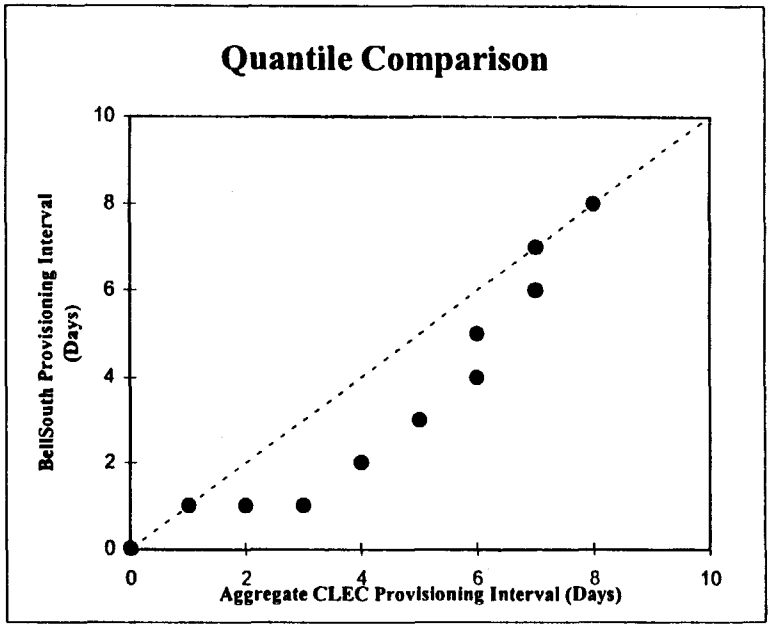
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-14.65	0.0000
FCC	-14.70	0.0000
BST	-4.06	0.0262

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services.
The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Adjusted
September BellSouth and CLEC Completion Interval-Provisioning
Baton Rouge Cases





Descriptive Measures

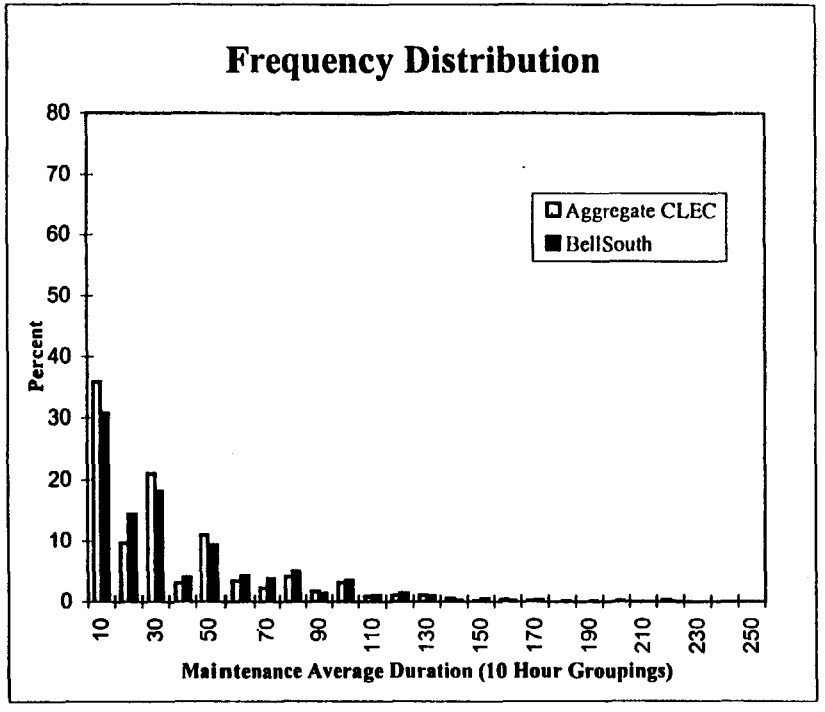
Service Provider	Mean	Standard Deviation
BST	1.45	2.62
CLEC	1.95	2.64
Difference	-0.50	

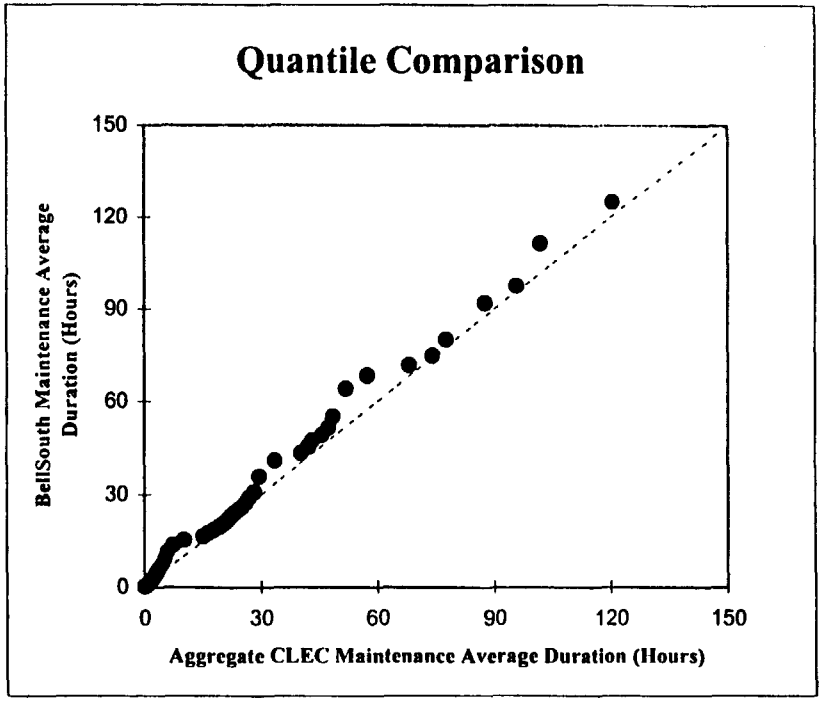
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-10.08	0.0000
FCC	-10.07	0.0000
BST	-3.15	0.2350

Data used in analysis does not include any records with missed appointments due to customer rescheduling or records corresponding to official services. The application of statistical trimming removed records with completion interval-provisioning of above 99 days. This resulted in the removal of no CLEC records and 0.004% of the BellSouth records.

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Shreveport





Descriptive Measures

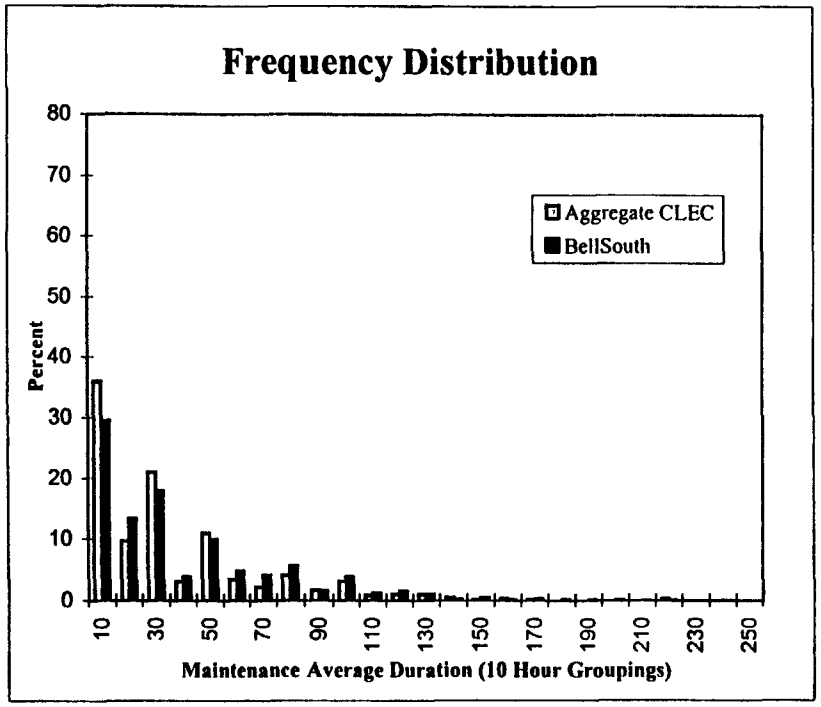
Service Provider	Mean	Standard Deviation
BST	33.11	34.39
CLEC	30.59	33.54
Difference	2.52	

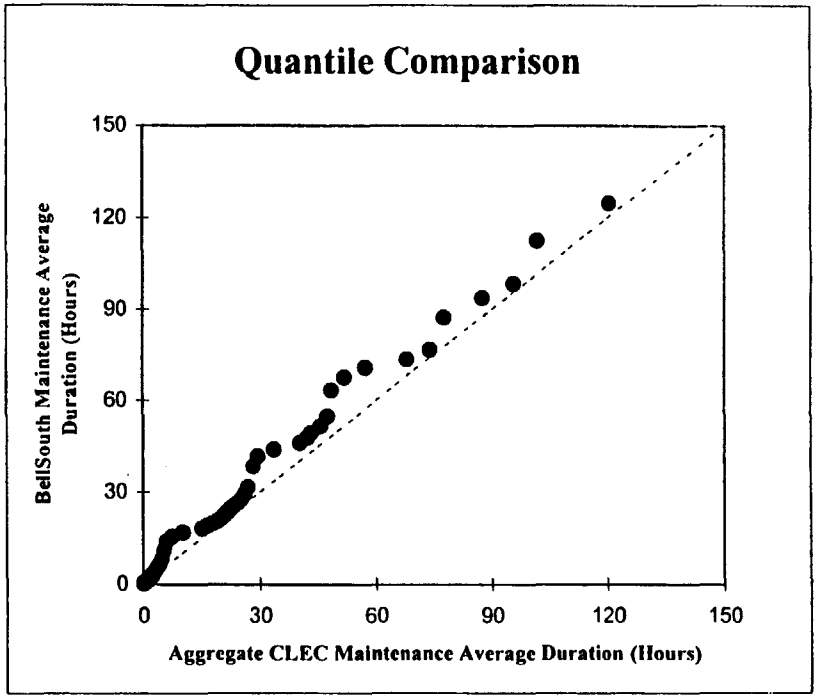
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	1.74	4.1195
FCC	1.74	4.1094
BST	1.04	15.3268

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Shreveport





Descriptive Measures

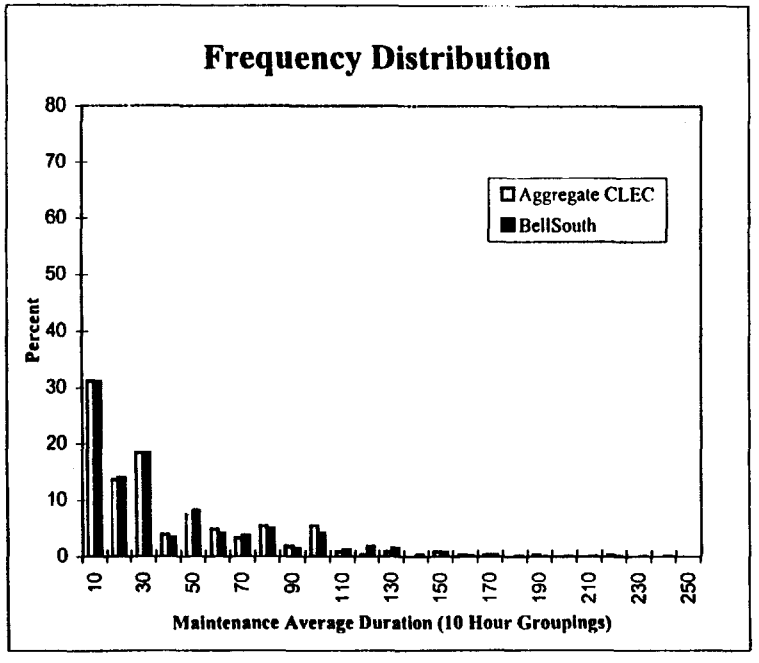
Service Provider	Mean	Standard Deviation
BST	34.71	35.04
CLEC	30.59	33.54
Difference	4.12	

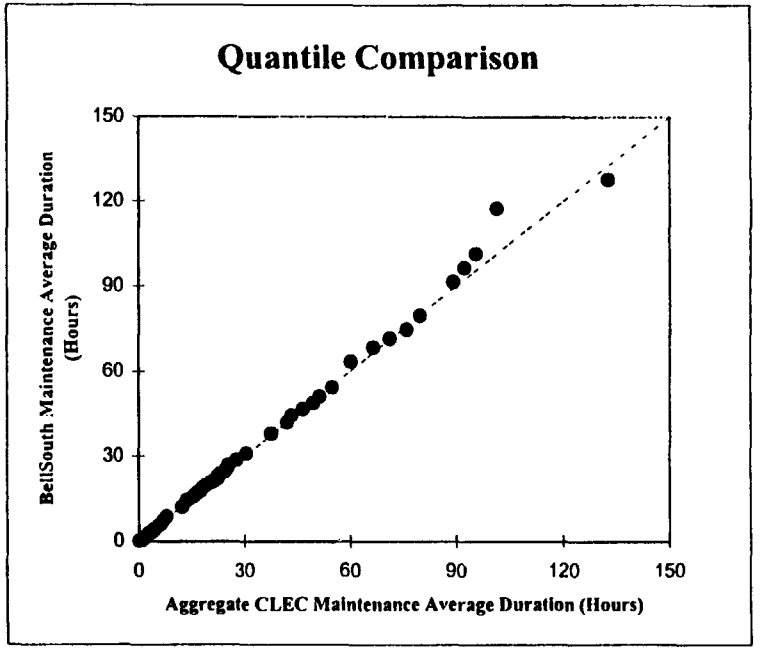
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.79	0.2631
FCC	2.79	0.2606
BST	2.35	1.2757

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Lafayette





Descriptive Measures

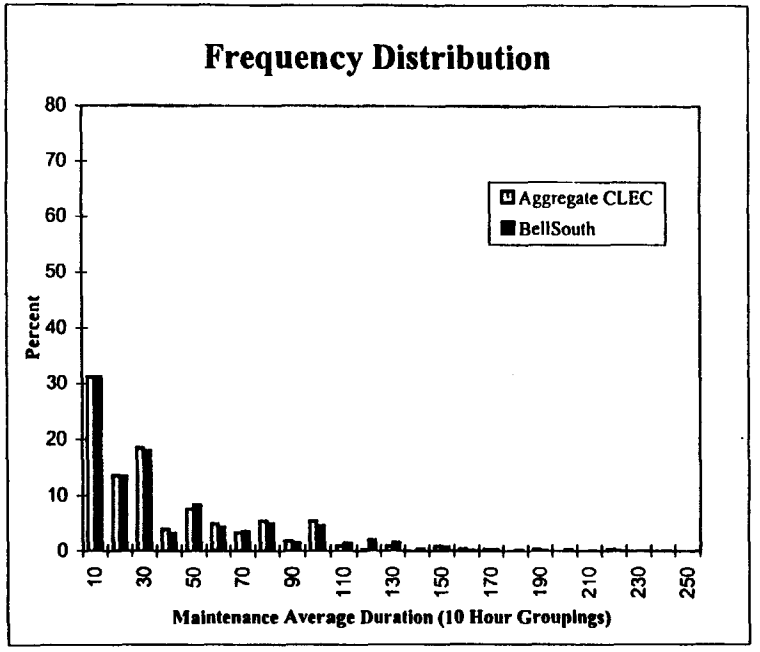
Service Provider	Mean	Standard Deviation
BST	34.31	36.13
CLEC	34.08	35.99
Difference	0.24	

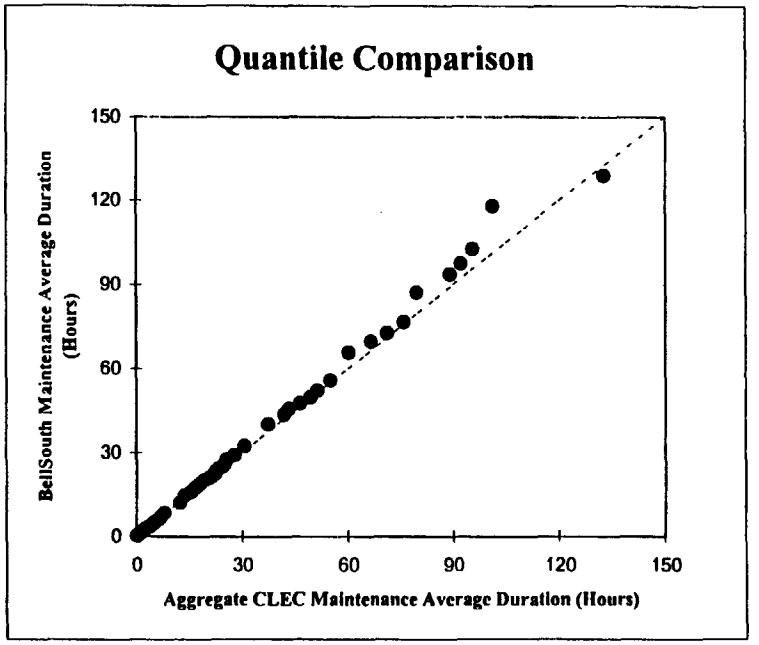
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.12	45.3007
FCC	0.12	45.3003
BST	0.10	46.0955

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Lafayette





Descriptive Measures

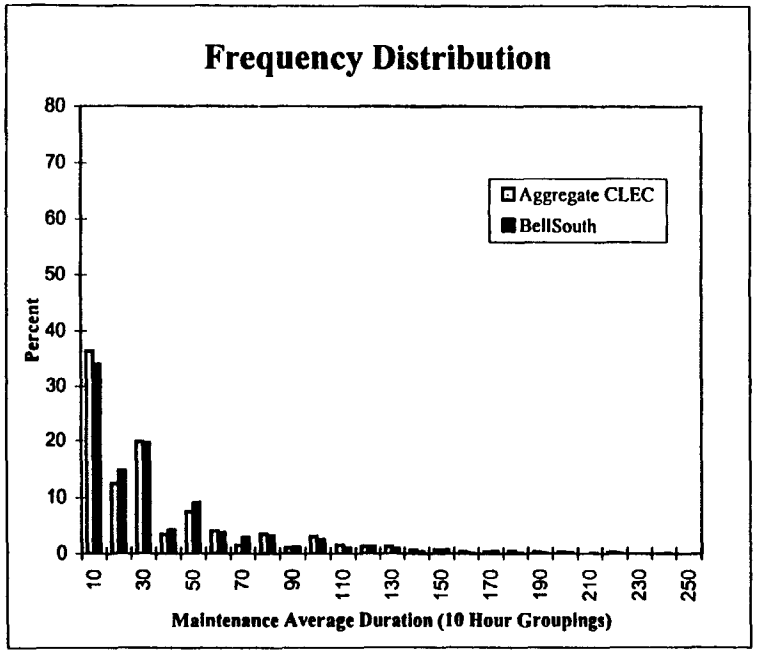
Service Provider	Mean	Standard Deviation
BST	35.14	36.93
CLEC	34.08	35.99
Difference	1.07	

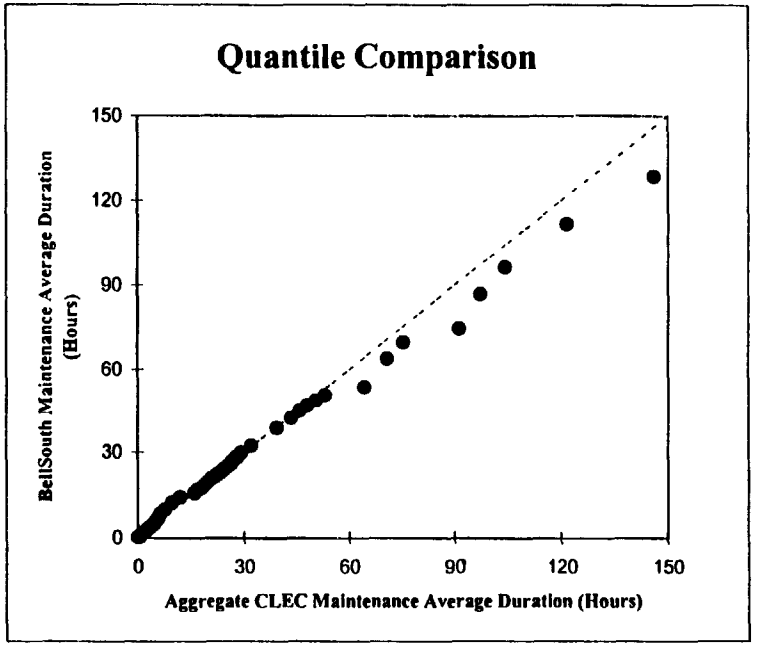
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.52	30.1862
FCC	0.52	30.1759
BST	0.40	34.6836

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
New Orleans





Descriptive Measures

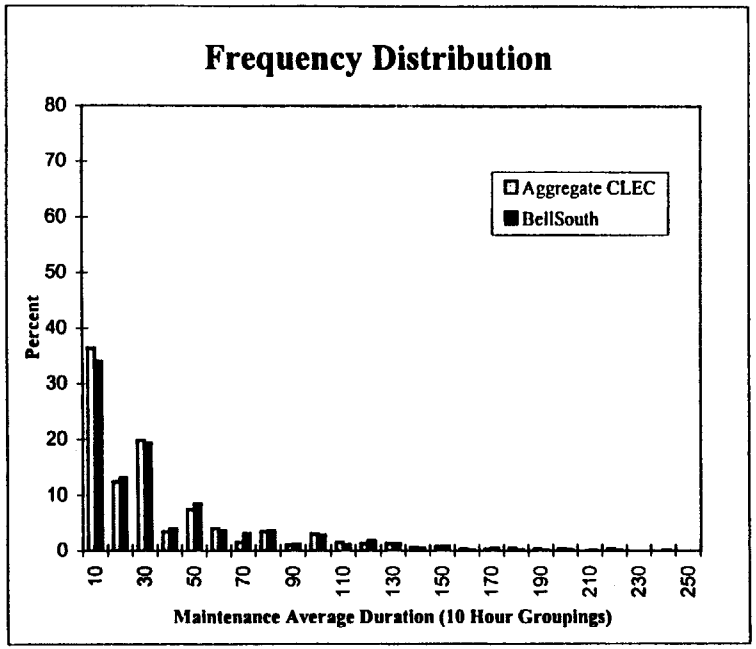
Service Provider	Mean	Standard Deviation
BST	30.01	33.75
CLEC	32.12	38.20
Difference	-2.10	

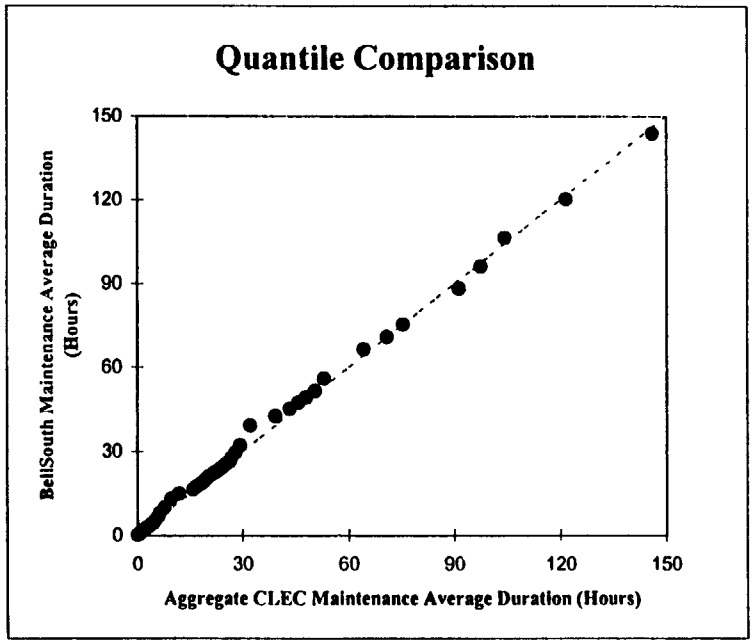
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	-1.62	5.2435
FCC	-1.62	5.2865
BST	-0.89	18.9890

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
New Orleans





Descriptive Measures

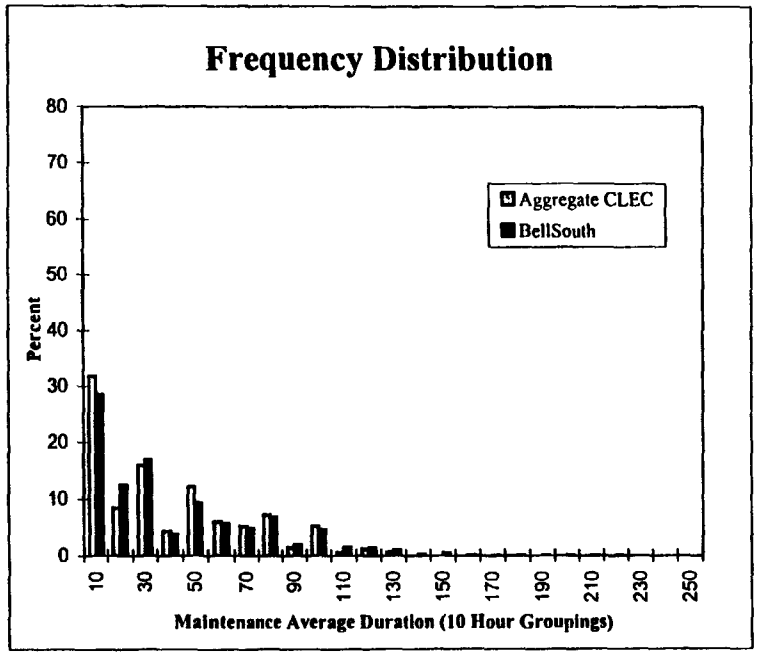
Service Provider	Mean	Standard Deviation
BST	32.59	37.19
CLEC	32.12	38.20
Difference	0.47	

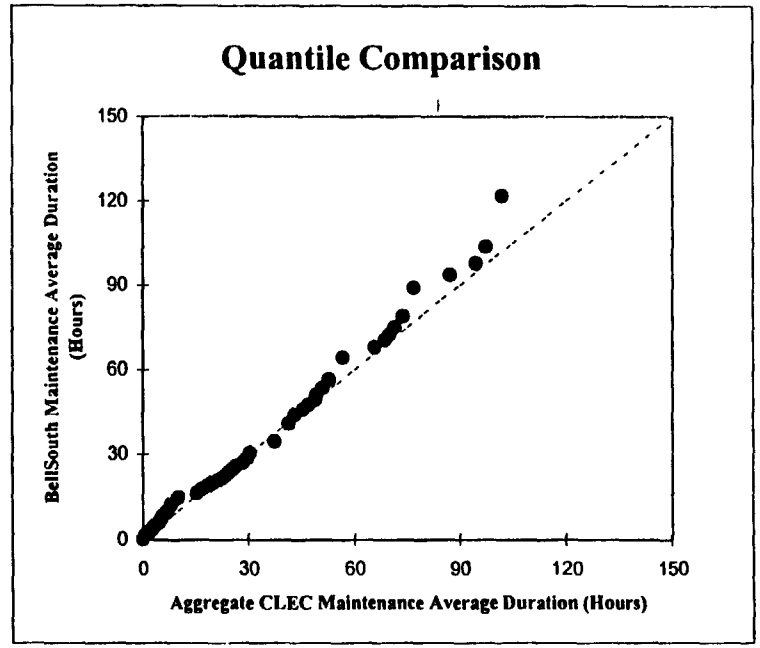
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	0.33	37.0821
FCC	0.33	37.0881
BST	0.21	41.7217

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Unadjusted
September BellSouth and CLEC Average Duration-Maintenance
Baton Rouge





Descriptive Measures

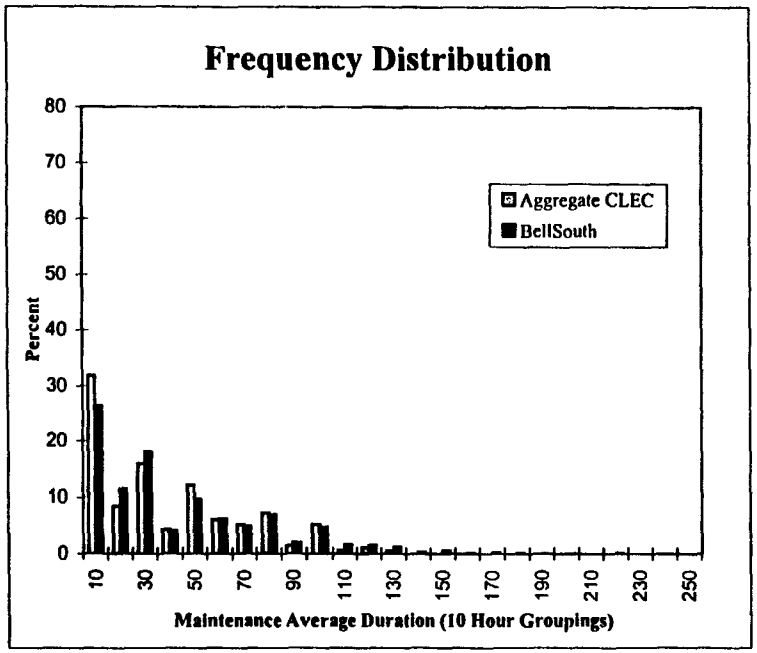
Service Provider	Mean	Standard Deviation
BST	36.28	34.29
CLEC	34.16	30.96
Difference	2.12	

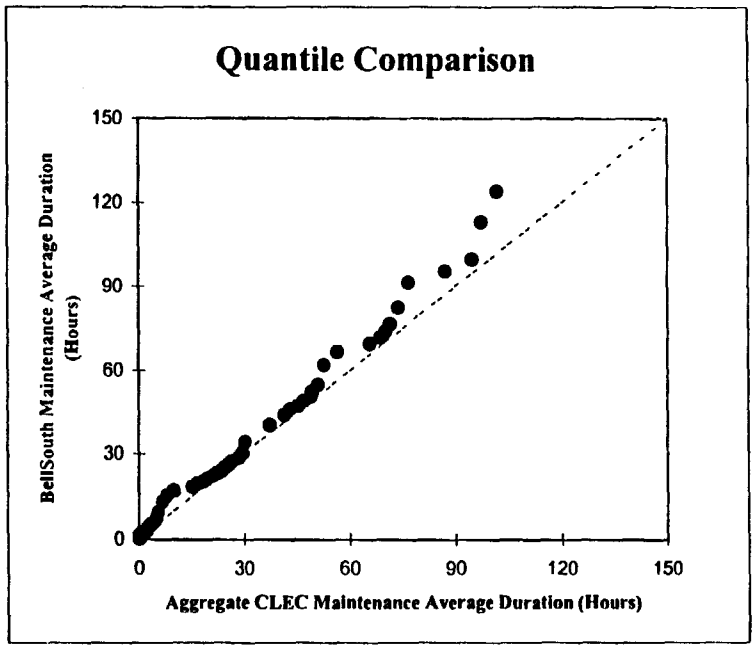
Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	1.14	12.7325
FCC	1.14	12.6809
BST	0.48	31.8749

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Adjusted
September BellSouth and CLEC Average Duration-Maintenance
Baton Rouge





Descriptive Measures

Service Provider	Mean	Standard Deviation
BST	38.06	35.01
CLEC	34.16	30.96
Difference	3.90	

Analytic Measures

Testing Method	Test Statistic	P-value (percent)
LCUG	2.05	2.0178
FCC	2.06	1.9922
BST	1.34	9.7173

Data used in analysis includes only direct customer reports. The results exclude in public service lines and durations > 240 hours

Appendix J
Aggregate Assessment of Nondiscrimination - Multiple Testing Isssues

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Appendix J
Aggregate Assessment of Nondiscrimination – Multiple Testing Issues

Background

It has been suggested that the results from a large number of BellSouth/CLEC performance parity tests could be combined and used to determine whether BellSouth is in compliance with its nondiscrimination obligation. In our view, while it is necessary to consider more than one performance measure when checking for parity, one must be careful in choosing the total number of tests to use.

It is important to realize that, due to random fluctuations inherent in statistical testing, BellSouth may fail some tests even though parity actually exists. The chance of this occurring increases with the number of tests that are aggregated. Dr. Colin L. Mallows, of AT&T Laboratories, describes a procedure for aggregating the results of many test that recognizes this fact.[1] His procedure contains two dimensions of statistical comparisons:

a) the number of tests that fail in any monthly period must not be too large, and

b) the number of tests that fail for three consecutive months must not be too large.

The statistical reasoning behind the procedure is based upon two key assumptions:

a) all parity measures within a given month are independent, and
b) consecutive monthly values of each parity measure are also independent.

In what follows, we

1. argue that these assumptions are questionable,
2. provide an example, via simulations, that shows that the suggested procedure does not produce the desired overall false alarm rate[2] when some measures are dependent,
3. suggest an alternative method for adjusting the false alarm rate of each individual test so

[1] Affidavit of Dr. Colin L. Mallows before the Federal Communications Commission, Washington, DC 20554. In the Matter of "Performance Measurements and Reporting Requirements for Operation Support Systems, Interconnection, and Operator Services and Directory Assistance." CC Docket No. 98-56, RM 9101. Section I, subsection D, ILECs' Compliance With Their Nondiscrimination obligations Should Be Based On An Aggregate Assessment Of Parity.

[2] The Type I error rate. A Type I error is concluding that parity does not exist when it in fact does. The probability that the given procedure leads to a Type I error is the false alarm rate.

that the resulting overall false alarm rate is no higher than the desired level,

4. show that other problems are encountered when the alternative method is used with too many tests, and
5. recommend that the total number of tests used to judge nondiscrimination be kept to a small number of independent tests, perhaps one from each of the main service quality measurement categories.

Lack of independence

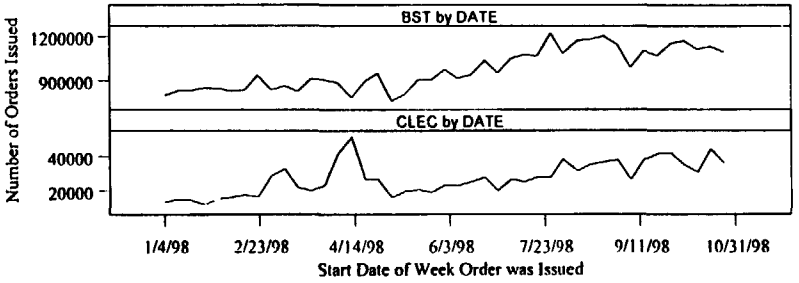
Many performance measures within the same Service Quality Measurement categories are calculated from a common set of data. While the measures quantify different aspects of performance, the fact that certain common variables are used in the calculations suggests that the measures will be correlated.

The Order Completion Interval, the Held Order Interval, and the Jeopardy Notice Interval all get quantified in two ways: by the average value, and by the distribution of the number of days in the interval. If, for example, parity tests of both the average and the proportion of intervals greater than five days are both included in an aggregation of tests, then there would be dependencies at least between the measurement pairs for each type of interval.

The Percent Missed Installation Appointments and the Order Completion Interval are also confounded. Those orders that have missed installation appointments will have longer completion intervals.

As for the independence of a particular measure between consecutive months, one needs to consider business trends over time. Figure 1 shows the number of weekly BST and CLEC service requests for the whole BellSouth region over the first ten months of 1998.

Figure 1 - Number of Weekly Service Request During the First Ten Months of 1998

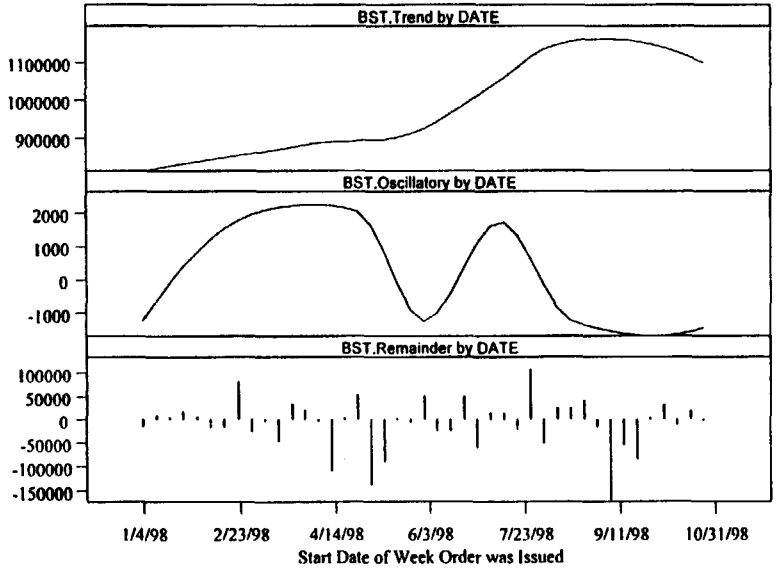


It is apparent that both the BST and CLEC series exhibit both an increasing trend, as well as some oscillations about that trend. To get a clearer picture of this, we can decompose each series into a trend, oscillatory, and remainder components.

We can do this by using repeated loess fitting as described by Cleveland.[3] Figure 2 show the results of this decomposition for the BellSouth series. Figure 3 show the CLEC results.

[3] Cleveland, W. S. (1993), *Visualizing Data*. Hobart Press, Summit, New Jersey.

Figure 2 - Decomposition of Weekly BellSouth Service Request Totals

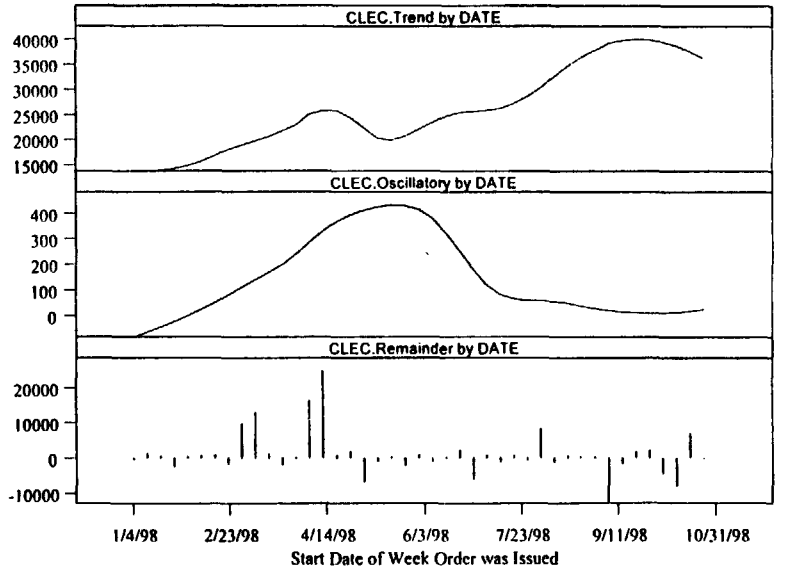


Both BellSouth and the CLECs have similar trend functions which show the effects of Hurricane Georges at the end of September. The oscillatory components are not alike.

BellSouth's data shows two oscillations, while the CLEC data shows just a single rise and fall. In fact, the CLEC data reaches a peak at about the same time point that the BellSouth data reaches a low point.

The remainder components for both series do not appear to follow any functional form. A check on this data was done, and both remainder series do not show any autocorrelation. Thus, they appear to be "white noise."

Figure 3 - Decomposition of Weekly CLEC Service Request Totals



Because of the structure present in business trends like these, one would expect many of the performance measures to have similar values in consecutive months. And parity tests that are based on measures that have month-to-month correlation will also exhibit correlation.

Effects of dependence on AT&T's suggested procedure

AT&T's suggested procedure calls for identifying three values:

1. the number of allowed individual parity test failures in a month, denoted by k_1,
2. the number of allowed three-consecutive-month failures of a parity test, denoted by k_2, and
3. the common false alarm rate of the individual tests, denoted by α_1.

AT&T suggests that k_2 be set to zero, arguing that the expected number of parity tests that fail in three consecutive months is small. This calculation assumes independence of tests from month-to-month.

The overall false alarm rate, α, is a function of

a) the three values k_1, k_2, α_1, and

b) the total number of individual parity tests, N.

By setting $k_2 = 0$, and assuming independence of tests within a month, as well as independence across consecutive months, the equation can be written as

$$\alpha = 1 - (1 - \alpha_1^3)^N \cdot P(k_1, N, p).$$

$P(k_1,N,p)$ is the cumulative binomial distribution. This gives the probability that there are at most k_1 false parity test failures out of N total parity tests when the probability of an individual false parity test failure is p. The false parity test failure probability, p, is computed as

$$p = \frac{\alpha_1 - \alpha_1^3}{1 - \alpha_1^3}.$$

By using this function, values of k_1 and α_1 can be found that provide a desired value of α.

For example, suppose that N = 100 parity tests are to be performed with an overall false alarm rate of 5 percent. Then it can be shown that $k_1 = 8$, and $\alpha_1 = 0.0460$ (4.6 percent). If an individual parity measure is calculated by standardizing the difference of average BellSouth and average CLEC performance (where the CLEC value is subtracted from the BellSouth value), then a conclusion of discriminatory behavior is reached if the parity measure is "too small."

The notion of "too small" is quantified by finding the value, C, in the parity measure distribution for which 100α percent of all values are less than it.[4] Under the right conditions, the parity measure distribution can be considered to be a standard normal distribution. In the previous example, the false alarm rate was 4.6 percent. Using a standard normal distribution, the critical value for the test is C = -1.685.

To see what happens when dependence exists between a set of parity tests within a given month, we performed a simple simulation experiment. Since we are only simulating parity measures within a month, the equation for determining k_1 and α_1 simplifies to

[4] This assumes that one wants to have a one tailed test. If a two tailed test is desired, then the point of discrimination is reached at the value of the parity measure distribution for which $100(\alpha/2)$ percent of all values are less than it.

$$\alpha = 1 - P(k_1, N, \alpha_1).$$

We set the overall false alarm rate $\alpha = 0.05$ (5 percent). The simulation proceeded as follows.

1. Set the total number of parity tests N = 5, 10, 50, 100, 500, or 1000.
2. Calculate k_1, α_1, and C by
   a) finding the value of k_1 such that $1 - P(k_1+1,N,0.05) \le 0.05 \le 1 - P(k_1, N,0.05)$,
   b) finding the value of α_1 such that $1 - P(k_1,N,\alpha_1) = 0.05$, and
   c) finding the value of C from the standard normal distribution so that $100\alpha_1$ percent of the distribution is less than C.
3. Generate a multivariate observation $\mathbf{Z} = (Z_1, Z_2, \ldots, Z_N)$ of parity measure results from a multivariate normal distribution where the correlation between parity measures Z_i and Z_j is give by

$$\text{corr}(Z_i, Z_j) = 1 - \frac{|i-j|}{N-1}, \quad i,j = 1,\ldots,N$$

So, for example, if N = 5, then the correlation matrix is given by

$$\begin{bmatrix} 1 & .75 & .5 & .25 & 0 \\ .75 & 1 & .75 & .5 & .25 \\ .5 & .75 & 1 & .75 & .5 \\ .25 & .5 & .75 & 1 & .75 \\ 0 & .25 & .5 & .75 & 1 \end{bmatrix}.$$

4. Count the number of times $Z_i < C$, i = 1,...,N. If this count is more than k_1, then tally this case as a false indicator of discrimination.
5. Repeat steps (3) and (4) 10,000 times.
6. The total tally of false indicators divided by 10,000 is an estimate of the overall false alarm rate of the aggregate test.

Table 1 shows the results of the simulation. Notice that the estimated overall false alarm rate is greater than the desired rate of 5 percent – especially as N gets large.

Table 1 - Summary of Simulation Results, the Consequences of Assuming Independence when Parity Tests are Correlated

Total Number of Tests N	Number of Allowable Test Failures k_1	Individual False Alarm Rate $100\alpha_1\%$	Critical Value C	Estimated Overall False Alarm Rate $100\alpha\%$
5	0	1.02	-2.3187	5.61
10	1	3.68	-1.7894	6.93
50	4	4.02	-1.7479	7.78
100	8	4.78	-1.6670	8.45
500	32	4.87	-1.6577	9.92
1000	61	4.99	-1.6455	9.55

The desired overall false alarm rate is 5 percent.

These results are only good for the type of correlation that was assumed to exist between parity measures. The correlation structure that is described above was chosen because it has a uniform mix of correlation levels between the parity measures.

While there is evidence that correlation exists between some parity measures, we do not know the exact nature of the structure across a set of parity measures. Thus, this simulation is only an example of what can happen to the overall false alarm rate when procedures based on independence of parity measures are used.

Alternative Procedures

If the distribution of the N monthly parity measures are reasonably approximated by a multivariate normal distribution, then one can use Scheffé's S-Method of multiple comparisons.[5] This method depends upon inverting a correlation matrix. If one wants to have a computational feasible problem, then a small number of parity tests should be considered.

If there is concern about the appropriateness of using the multivariate normal distribution to model the distribution of the N monthly parity measures, then one can employ the Bonferroni inequality.[6] This is a relationship which holds whether or not the individual parity tests are independent.

Let $Z_1,\ldots,Z_N$ be the results of N monthly parity measures, C be the common critical value for the parity tests, and α_1 the common false alarm rate for each parity test. If one sided tests are being performed, the Bonferroni inequality can be written as

$$1-P(Z_1 \geq C,\ldots,Z_N \geq C) \leq \sum_{i=1}^{N} P(Z_i < C) = N \cdot \alpha_1 .$$

The left side of this relationship is the probability of having at least one parity tests out of N fail. The relationship implies that if you do not allow any parity test failures out of the N monthly tests, then the overall false alarm rate when performing multiple comparisons is no more than

$$\alpha = N \cdot \alpha_1 .$$

[5] Scheffé, H. (1959), *The Analysis of Variance*, J. Wiley & Sons, Inc., New York.

[6] The Bonferroni inequality is discussed in numerous probability and statistics text books. For example, Mendenhall, W., Scheaffer, R.L., and Wackerly, D. D. (1986), *Mathematical Statistics with Applications, Third Edition*, Duxbury Press, Boston.

Thus, you can obtain a maximum overall false alarm rate of α if you set the individual test false alarm rate to α/N.

Potential Problems

The two methods suggested in the previous section may cause problems if the number of monthly parity test is large. It has already been pointed out that Scheffé's S-Method may be computationally infeasible for large N. Using a Bonferroni approach presents two other types of problems.

First, the fact that no failures are allowed over all the tests may be an overly strict rule when N is large. This is compensated for by making the individual false alarm rate small. But this just means that only very extreme parity measures will result in a discriminatory conclusion.

Second, very small false alarm rates correspond to extreme critical values, but determining these values may not be easy. And they may also not be the same for all parity tests.

To get an understanding of this, suppose 1,000 monthly parity tests are to be performed with an overall false alarm rate of 5 percent. Then the individual test false alarm rate is 0.005 percent. If we use the standard normal distribution to determine the critical value then C = -3.891.

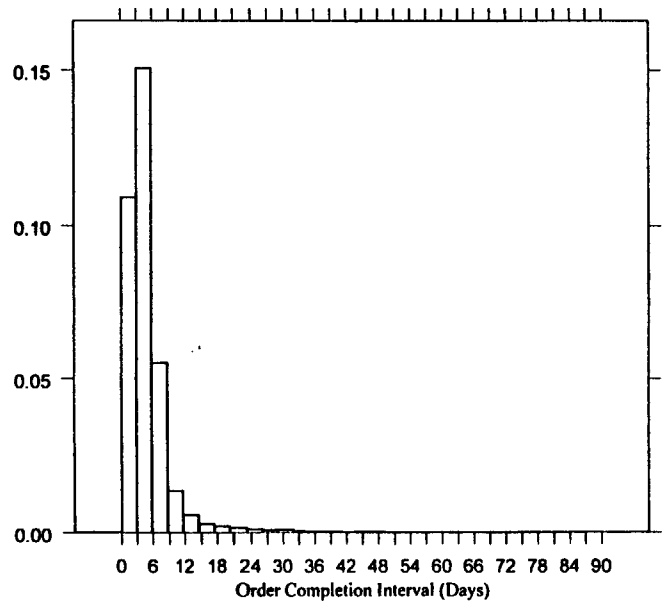
A provisioning measure like the order completion interval is recorded in terms of whole days, and often has a few extreme values. Thus, it is a highly skewed, discrete distribution.

The Central Limit Theorem states that the distribution of the average of a sample of values can be approximated by the normal distribution provided the sample is "large enough."[7] Determining how large is "large enough" depends on the underlying distribution of the data. Skewed distributions tend to need larger samples than symmetric ones, though.

To see what happens when computing parity measures from such distributions, we conducted a simulation experiment. We used the empirical distribution of the BellSouth, August Order Completion Interval (OCI) data for dispatched, residential orders with less than ten circuits to draw samples from. Figure 1 is a histogram of this data. The histogram shows that this is a highly skewed distribution.

[7] In general, it does not matter what the underlying distribution of the sample values is, provided certain conditions are met. A distribution with finite variance is sufficient for the theorem to hold, although there are more general conditions under which the theorem is valid.

Figure 4 - Distribution of BellSouth's Order Completion Interval for Dispatched, Residential Orders with Less Than 10 Circuits



The simulation was conducted using the following steps.

1. Draw a sample of size 8,000 from the OCI distribution. This represents the BellSouth orders for the month.
2. Compute $\bar{x}_B$ and s_B, the sample mean and standard deviation of the BellSouth sample.
3. Draw a sample of 500 from the OCI distribution. This represents the CLEC orders for the month.
4. Compute $\bar{x}_C$, the sample mean of the CLEC sample.
5. Compute the LCUG parity measure

$$z = \frac{\bar{x}_B - \bar{x}_C}{s_B \sqrt{\frac{1}{8000} + \frac{1}{500}}}.$$

6. Repeat steps (1) through (5) 100,000 times, storing the z scores.

Figure 2 is a Normal Q-Q Plot of the 100,000 z scores. This is a plot of the estimated quantiles of the parity measure distribution against the same quantiles of the standard normal distribution. If the distribution of the parity measure is normal, the plot should look like a straight line.

The plot shows that the parity measure distribution differs from a normal distribution in the extreme tails. This, though, is the region that determines the critical value for individual tests if the Bonferroni method is used with a large number of tests.

Figure 5 - Normal Q-Q Plot of 100,000 Simulated LCUG Z Scores

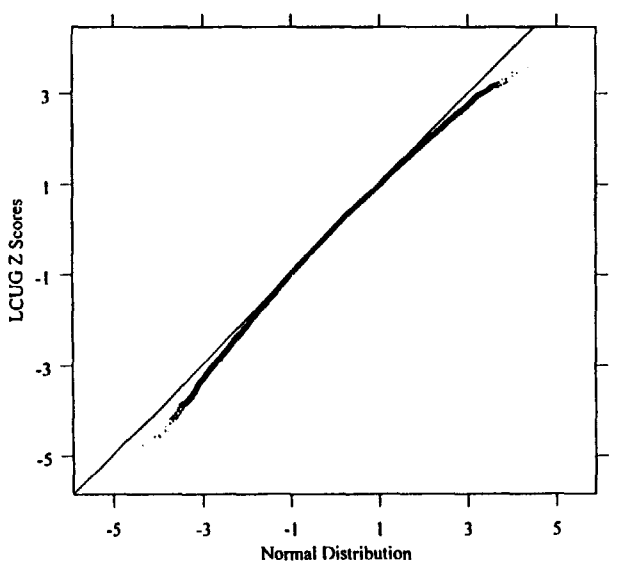


Table 2 gives a numerical comparison of some of the quantiles of the simulated parity measure distribution with the standard normal quantiles. They compare fairly well between the 10th and 85th percentiles, and might be acceptable if the range is expanded to included the 0.5 percentile on the low end, and the 95th percentile on the high end.

Table 2 - Quantile Comparison of the Simulated LCUG Z Score and the Standard Noraml Distributions

Percentile	Estimated LCUG Z Quantile	Standard Normal Quantile
0.5	-2.802	-2.576
1	-2.506	-2.326
5	-1.720	-1.645
10	-1.312	-1.282
0	0.029	0.000
80	0.840	0.842
85	1.022	1.036
95	1.578	1.645
99.5	2.372	2.576

In terms of applying the Bonferroni inequality to find the individual false alarm rate of each parity test, these results suggest the following.

> If the desired overall false alarm rate is 5 percent, then the value of N should not be larger than 10.[8]

These results only pertain to samples from distributions similar to the empirical distribution used in the simulations. But they do point out possible problems when using the Bonferroni methodology with a large number of monthly parity tests.

[8] The value of the individual false alarm rate is 5 percent divided by 10. This results in .5 percent, which is the minimum value of agreement between the LCUG Z and standard normal quantiles.

Conclusions

The quantification of performance is an important aspect of quality management. Therefore it is important that BellSouth continue to measure its performance in many different ways.

When it comes to making judgements as to whether or not BellSouth is meeting its nondiscriminatory obligation with respect to the service it provides CLECs and their customers, there are potential problems that can arise when the results of too many parity tests are aggregated. These problems include: dependencies that exist between parity tests, dependencies between consecutive monthly measurements, and parity measures with non-normal distribution.

Our analysis indicates that these problems are negligible when the results of only five to ten parity tests are aggregated in any given month. Furthermore, to guard against dependencies between parity test, a methodology based on the Bonferroni inequality should be used in the aggregation process.

It is useful to point out that both the Bonferroni methodology and the AT&T proposed methodology are approximately the same when only five parity tests are aggregated. When applying AT&T's procedure to five parity tests, no failures are allowed within a month, and the false alarm rate for each individual test is 1.02 percent. A Bonferroni approach would call for pretty much the same procedure – the individual false alarm rate, though, is exactly 1 percent.

Also, if the number of tests is under ten, then the individual test false alarm rate will be greater than 0.5 percent when a Bonferroni procedure is used. This means that the critical value for the individual tests will not come from the extreme tail of a theoretical distribution like the standard normal or Student's t distribution. This is important since simulations suggest that the distribution of extreme values for some parity scores are not modeled well by these distributions.

With respect to comparing parity tests over time, more information is need before we can recommend a procedure. For example, data from more months should be examined to determine the extent of dependencies between monthly parity test results.

Appendix K
Glossary of Acronyms and Statistical Terms

I. Acronyms K-1

II. Statistical Terms K-1

Appendix K
Glossary of Acronyms and Statistical Terms

This glossary defines some of the acronyms and the technical statistical terms found in the body of the report. A general reference to consult for more detail is Snedecor, G. and Cochran, W.G. (1989*), Statistical Methods, Eighth Edition*, Iowa State University Press, Ames.

Acronyms

BST: BellSouth Telecommunications, Inc.

CLEC: Competing Local Exchange Carriers

DOE: Direct Order Entry System

FCC: Federal Communications Commission

IID: Independent and Identically Distribution

ILEC: Independent Local Exchange Carriers

LENS: Local Exchange Negotiation System

LCUG: Local Competition User Group

LATA: Local Access Transport Area

OSS: Operating Support Services

RNS: Regional Negotiation System

SQM: Service Quality Measurement

UNE: Unbundled Network Element

Statistical Terms

Adjusted Data: Scaling down the volume of the BellSouth data so the variables can be more accurately compared to CLEC data.

Biased Estimate: An estimate is biased if there is a systematic tendency to overestimate or to underestimate the variable being estimated.

Central Limit Theorem: One of the most fundamental theorems of statistics, it states that even if the original population is not normally distributed, the distribution of means from repeated random samples will be approximately normal.

Confidence Interval: Indicates the precision of an estimate. A 95 % confidence interval is a range of values (the estimate + or - some value) such that, were the experiment repeated many times, approximately 95% of the ranges would contain the true population value.

Correlation: Measures the strength of the relationship between two variables. A correlation coefficient ranges from -1 to +1 and indicates a positive relation (+ values) or an inverse relation (- values); the closer the value is to +1 or -1, the stronger the relationship between the two variables.

Critical Value: The value of the test statistic that separates the acceptance region from the rejection region.

Critical Region: A region of test statistic values for which the null hypothesis is rejected. Also called the rejection region.

Degrees of Freedom: Relates to the calculation of the **variance** -- (n - 1) deviations from the mean.

Estimate: An estimate is any value calculated from a sample.

Favor: **Statistically Significant** differences that are +2 or larger are defined to be differences which "favor" the CLECs; those that are -2 or smaller are defined to be differences which "favor" BellSouth.

(Relative) Frequency Distribution: An initial indication of what the data look like, that is how the data are distributed. A frequency distribution indicates the number of observations falling within a given class. A **relative frequency distribution** shows the proportion of observations that fall into each class.

Heavy Tailed Distribution: See **normal distribution.** A concentration of observations at one end of the distribution. For example, a distribution of the weights of elephants at a zoo would probably have mostly large weight values and few small values. The distribution of this data would have a heavy tail on the right side, indicating a disproportionate number of observations with large values.

Homoscedasticity: If all the error terms have the same variance, the errors are homoscedastic. If the error terms do not have the same variance, they are called **heteroscedastic.**

Independence / Dependence: Observations A & B are said to be independent when the value of observation A has no influence on the value of observation B. Observations C & D would be dependent if the value of observation C influences the value of observation D, or vise versa.

Least Trimmed Squares Regression[1]: A regression technique introduced in Rousseeuw (1984). This regression method minimizes the sum of the q smallest squared residuals, where q is an integer between (roughly) n/2 and n. This method is robust in that it guards against extreme outliers influencing the functional fit.

Mean: The average value of a set of quantitative data.

Normal Distribution: A set of data has a normal distribution if a graph of the distribution produces a bell-shaped curve. Most of the observations are concentrated near the middle (mean) of the distribution and as you move outward from the middle, either left or right, there is gradually less and less data. A **Standard Normal** has a mean of 0 and a variance of 1.

Null Hypothesis: A statistical hypothesis is a statement about one ore more parameters of a population distribution that requires verification. The null hypothesis is the one whose tenability is actually tested.

One- and Two-tailed tests: A statistical test for which the critical region is in either the upper or lower tail of the sampling distribution is called a one-tailed test. If the critical region is in both the upper and lower tails of the sampling distribution, the statistical test is called a two-tailed test.

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[1] Rousseeuw, P.J (1984). Least median of squares regression. Journal of the American Statistical Association, 79, 871-881.

Outlier: Extreme values found in the data. Outliers can skew the value of the mean. Outliers are often removed to prevent undue influence upon the estimates for the data.

P-value: The P-value indicates if a test statistic is statistically significant. If the P-value for a test statistic in a one-tailed test is greater than 5%, then generally speaking, the test is not considered statistically significant.

Percentile: If all the observations are arranged in ascending order, the N^{th} percentile is the value of X such that N% of the observations are less than or equal to X. For example, we could say that 25% of the observations are less than $15 and 75% of the observations are greater. Thus, $15 would be the value of the 25^{th} percentile.

Quantile: The first quartile is a particular quantile. The value that the distribution takes at the 25^{th} percentile.

Replicate Method: A statistical method that involves the partitioning of a sample into subsamples. See Appendix B.

Sample: A part or piece taken as representative of a whole group (population).

Simulation: A controlled statistical sampling technique (experiment) that is used, in conjunction with a model, to obtain approximate answers for questions about complex, multifactor probabilistic problems, usually using a computer. It is most useful when analytical and numerical techniques cannot supply answers

Standard Deviation: indicates how the data are spread about the mean; the larger the standard deviation, the more spread out the data about the mean. Can be calculated for any set of data but it is most meaningful when the data are symmetric. The standard deviation is the square root of the variance.

Statistically Significant: A statistically significant result is a result that cannot be reasonably explained by sampling error. In this report, statistical significance is defined to have been reached when the test statistic is outside the range $\pm$ 2. By convention, when the difference is positive, we say the measure suggests that the CLECs resale customers are getting better treatment than BST retail customers. The reverse is true if the sign of the difference is negative. See "**favor**."

Symmetric: A distribution is described as symmetric if the left half of the distribution is the mirror image of the right half. A distribution is **skewed** if it is not symmetric. A distribution is heavy tailed if data are concentrated in one of the tails.

Test Statistics - Z-test and t-test (modified z-test, pooled z-test): A test statistic is used to make a decision about a parameter by testing hypotheses. Hypothesis testing helps us to choose between two conflicting hypotheses, a null and an alternative hypothesis, about the possible values of the parameter in question. These hypotheses make statements about the value of a particular parameter or groups of parameters. A critical value is calculated which determines what values of the test statistic will result in the acceptance of the null hypothesis and what values will result in the rejection of the null hypothesis. If the test statistic computed assumes a value in the rejection region, the null hypothesis is rejected in favor of the alternative hypothesis.

Time Series: An ordered sequence of observations, usually in terms of time. The observations are dependent or correlated, so the order of the observations is important. We can describe a

set of data by examining how the data change over time and if there is a describable pattern of behavior over time.

Variance: A summary statistic for measuring variation in a set of data. This measure of central tendency measures the average of the square deviations from the mean. See **standard deviation**.